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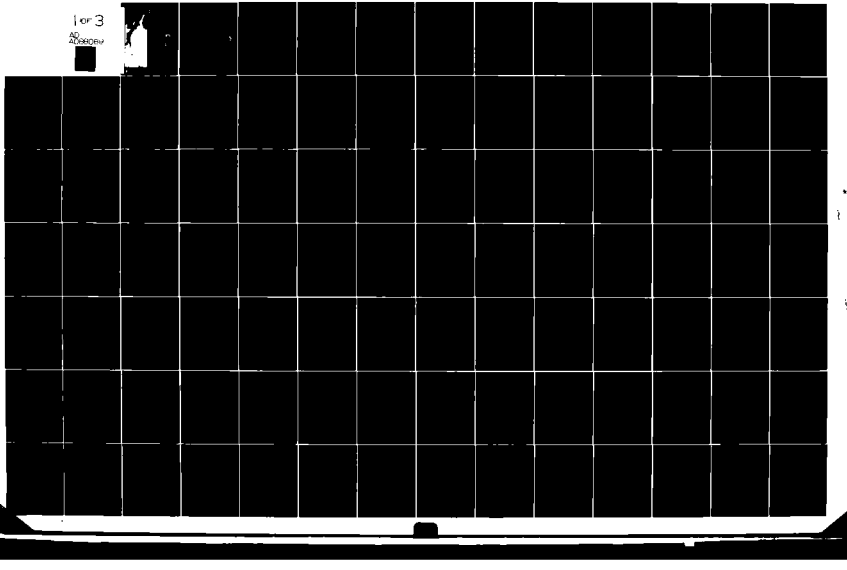

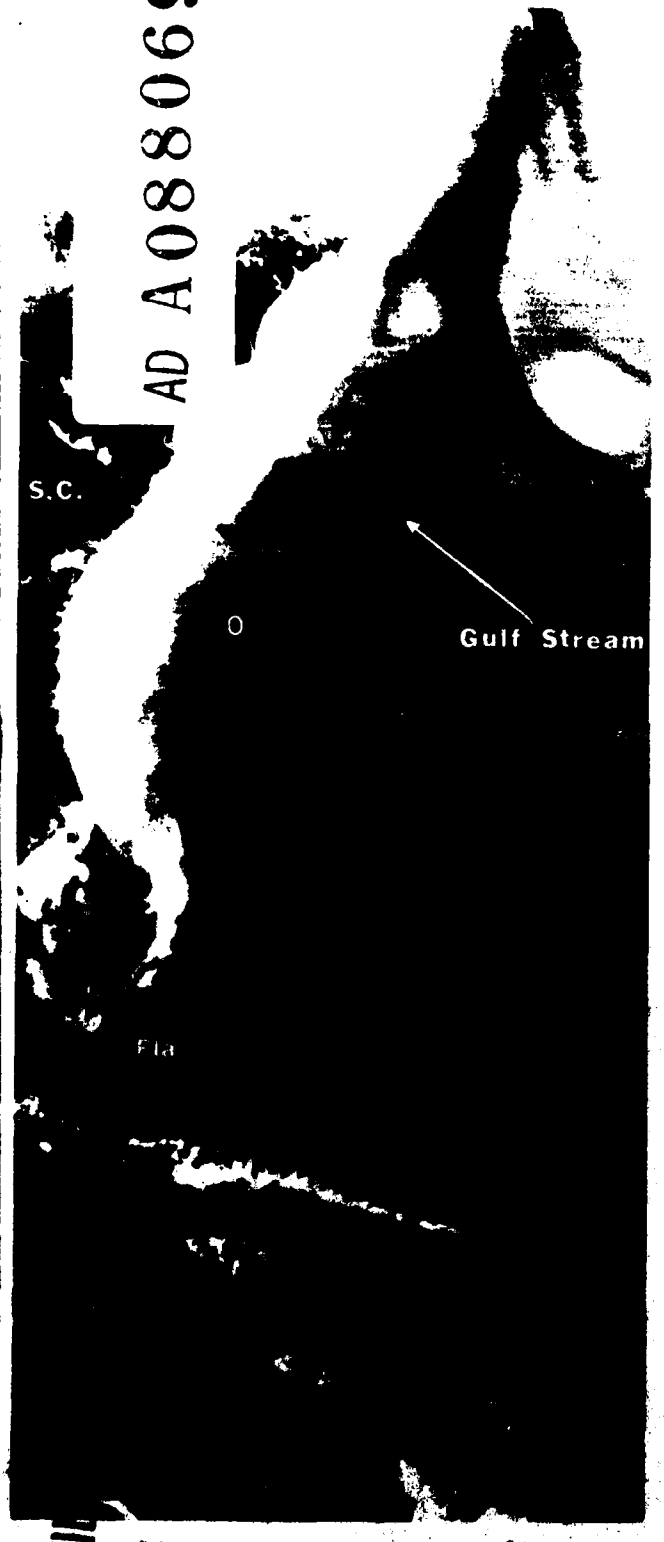

THE GULF STREAM MEANDERS EXPERIMENT

Current Meter, Atmospheric, and Sea Level Data Report for the January to May, 1979 Mooring Period

by

David A. Brooks

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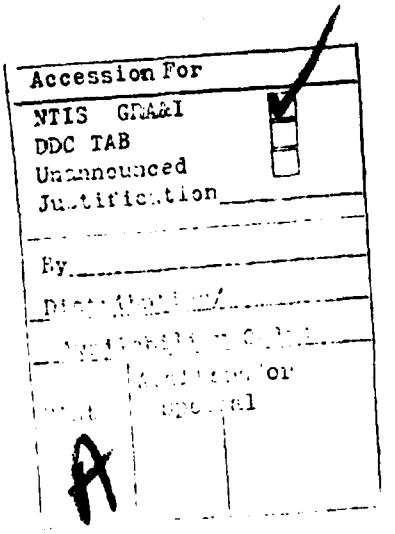
[1] University of North Carolina at Chapel Hill.
[2] North Carolina State University at Raleigh

FOREWORD

This is the second in a sequence of seven reports from the Gulf Stream Meanders Experiment. The field phases of the experiment were implemented as a joint project of principal investigators at Texas A&M University (DAB), and at the University of North Carolina at Chapel Hill (JMB). The complete set of reports, not necessarily listed in their order of availability, is expected to be:

1. Hydrographic Data Report, EN-031 (Jan 79) and EN-037 (May 79). TAMU Technical Report 80-1-T, January 1980, 145 pp.
2. Current Meter, Atmospheric, and Sea Level Data Report for the January to May 1979 Mooring Period. TAMU Technical Report 80-7-T, July 1980, 264 pp.
3. Hydrographic Data Report, EN-040 (Aug 79) and EN-045 (Nov 79)
4. Current Meter, Atmospheric, and Sea Level Data Report for the August to November 1979 Mooring Period.
5. Air-dropped XBT survey data report, Feb 79.
6. Air-dropped XBT survey data report, Nov 79.
7. Final project technical report.

Reports number 4, 5, and 6 will be issued at the University of North Carolina.



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SECTION 1

Setting and Design of the Experiment

1.1 HISTORICAL ASPECTS

The principal objective of the Gulf Stream Meanders Experiment was to kinematically and dynamically describe the nature of meanders. The upper continental slope region off Onslow Bay, North Carolina (inset box, Fig. 1) was chosen for the experiment site because several previous investigations in that area provided a baseline data set giving some ideas about time and space variability scales within and a several-month mean view of the Stream (Webster, 1961a, b; Richardson, *et al.*, 1969). In addition, earlier observations ranging from reports in centuries-old ship logs to recent satellite infrared imagery made it apparent that Gulf Stream meandering was more intense between Charleston and Cape Hatteras than elsewhere in the South Atlantic Bight (Fig. 1). For more details on the historical aspects and preliminary interpretation of the data presented here, see Brooks and Bane (1980).

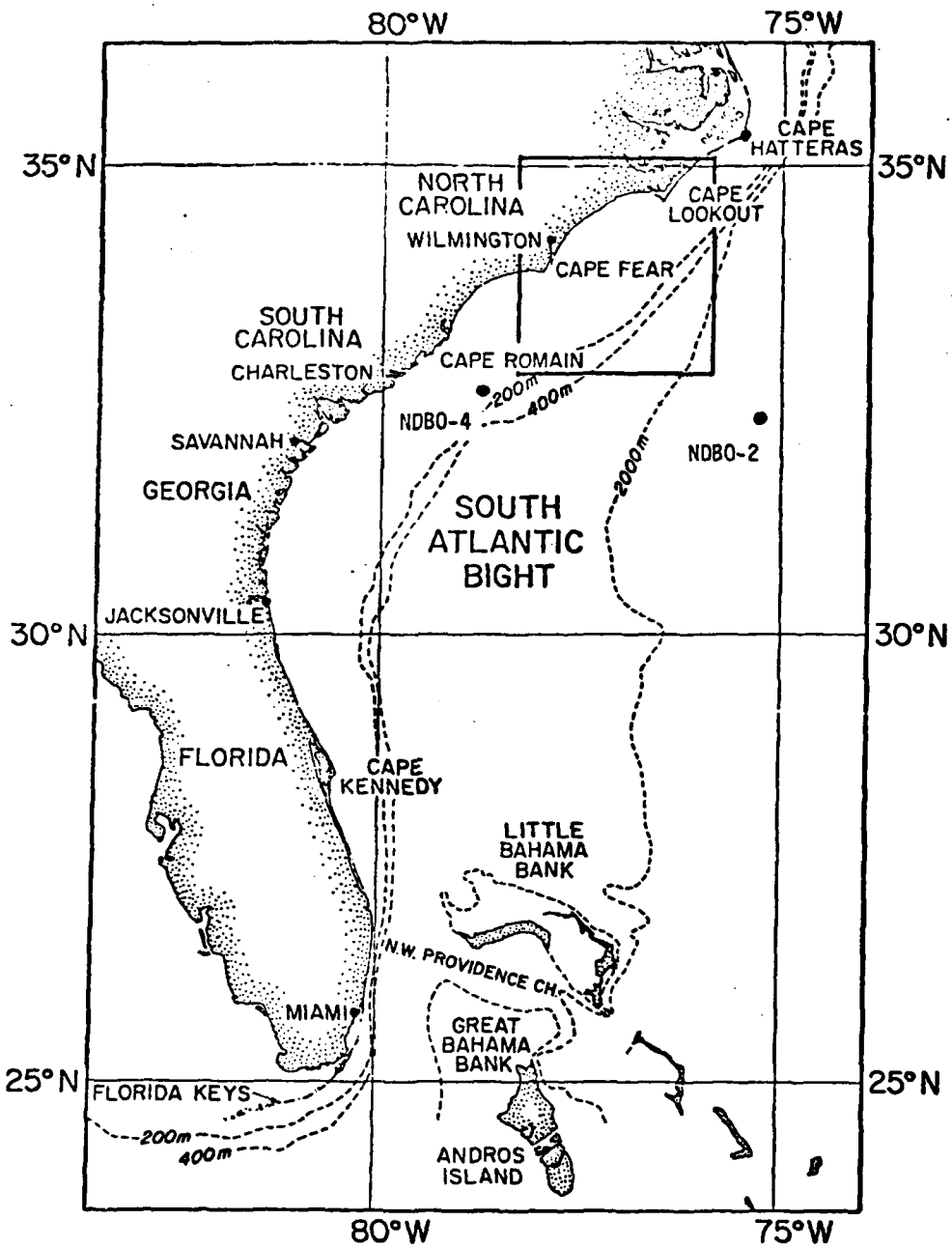


Figure 1. Map of the South Atlantic Bight, showing the location of the Gulf Stream Meanders Experiment (inset box). Atmospheric data from moored NOAA buoy NDBO-4 and from Cape Hatteras are shown in this report. [NDBO-2 data were not available in time for this report, but will be shown in a subsequent one.]

1.2 THE MOORED INSTRUMENT ARRAY

Averaged over two months, the Gulf Stream current speed on a section perpendicular to the topography off Cape Fear shows a broad, surface-intensified core (Richardson, *et al.*, 1969) extending over most of the upper continental slope (Fig. 2). Viewed on shorter time scales, however, the Stream core may be much narrower, with surface speeds considerably higher than those shown in Fig. 2. The Stream core wanders laterally over the upper slope with excursions of tens of kilometers (Webster, 1961a). Such a dynamically active region poses severe practical constraints on an experiment employing moored instruments, because the intense and highly variable current forces tend to push moorings over in the water column. Drawing on previous mooring experience in the Florida Current (Düing, 1973), we decided to deploy an L-shaped array consisting of four high-tension, subsurface moorings, each supporting two or three Aanderaa RCM-4 current meters in the lower half of the water column. The array was aligned with the local topography, with the long (75 km) leg of the "L" on the 400 m isobath. For perspective, the two moorings forming the short (15 km) leg of the "L" are shown projected about 10 km upstream onto Fig. 2. The plan view of the array is shown in Fig. 3, which is a more detailed map of the region in the inset box of Fig. 1. Mooring "D" is shown displaced for clarity.

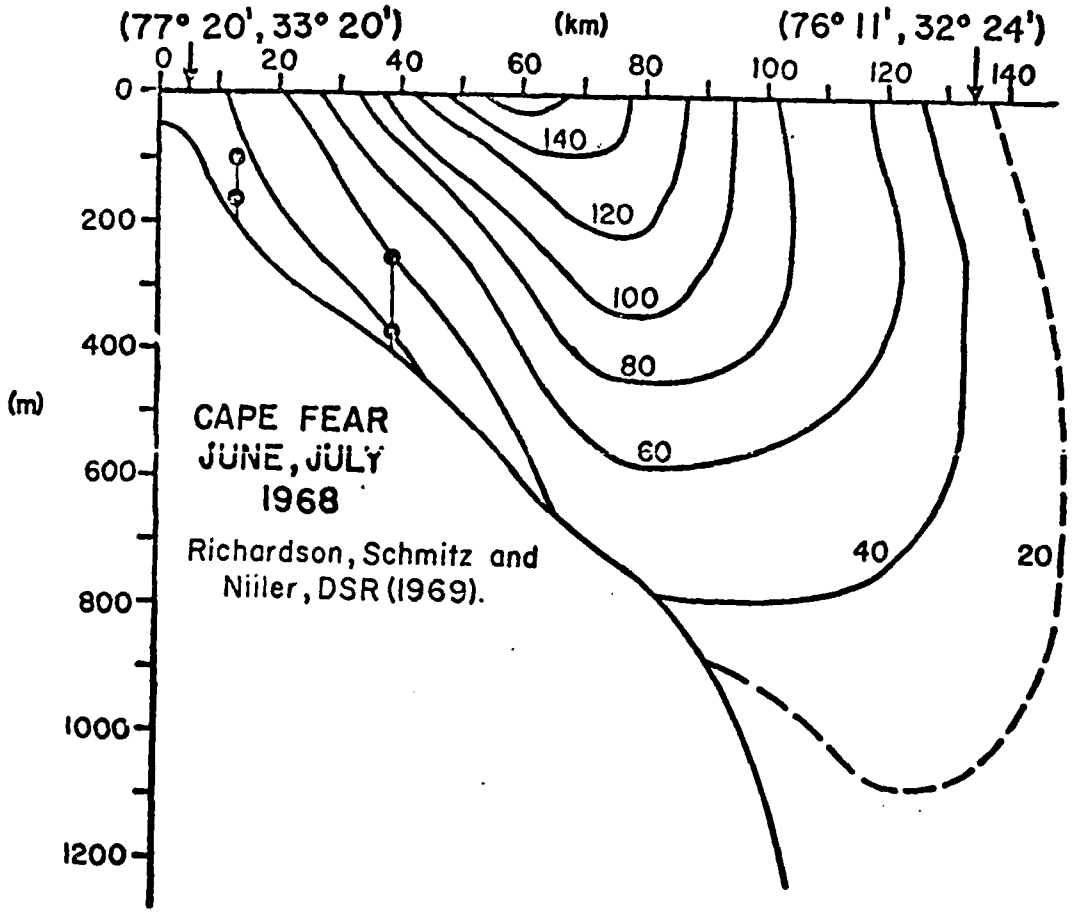


Figure 2. Cross-shelf section of the Gulf Stream off Cape Fear, showing two-month mean summer isotachs. The position of the A and B mooring current meters have been projected about 10 km upstream onto this section.

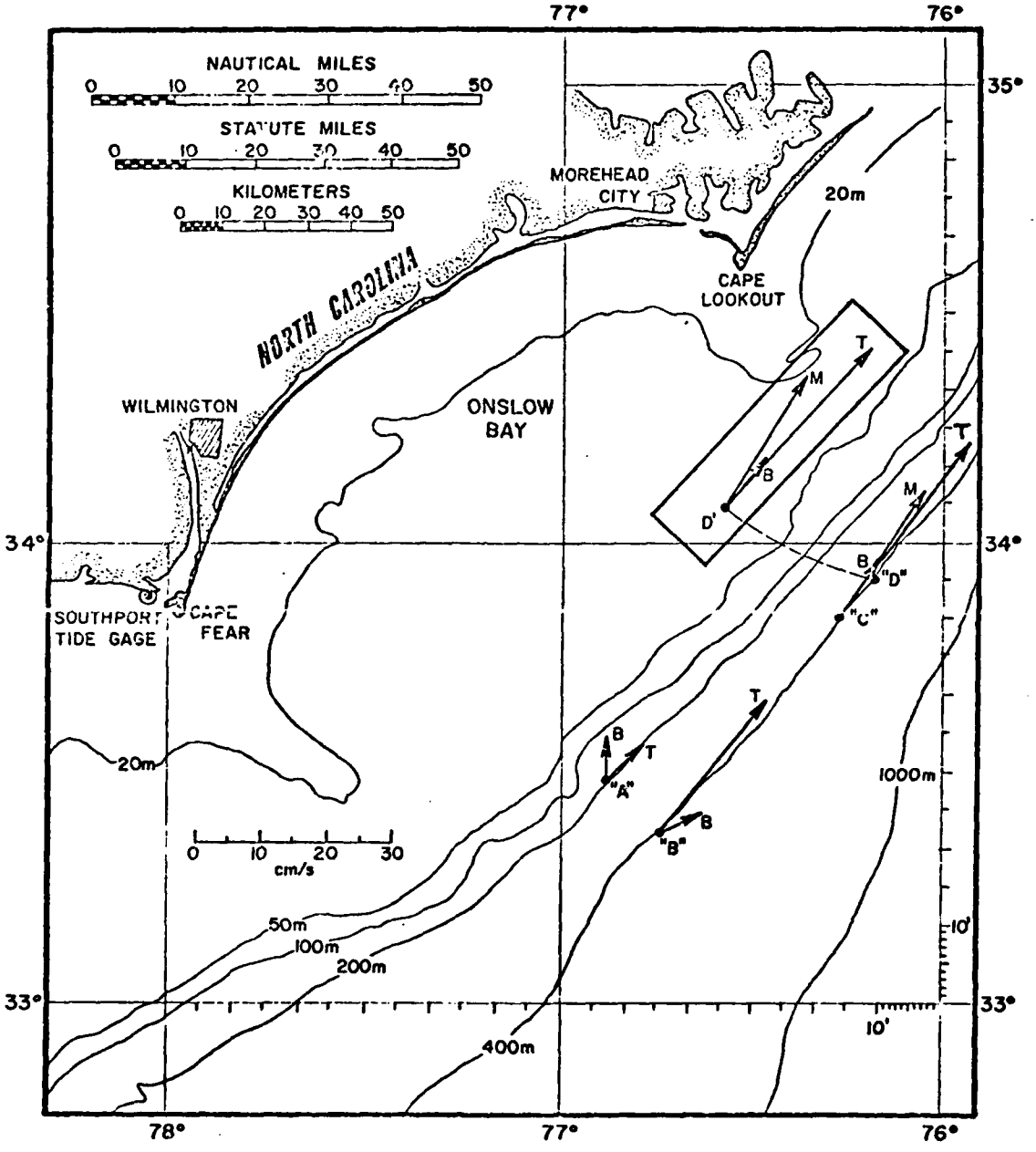


Figure 3. Detailed map of the experiment area (the inset box Fig. 1), showing the locations of moorings "A" through "D", with the record-long mean current vectors at the top (T), middle (M), and bottom (B) instruments. The mooring "D" position is shown displaced (inset box) for clarity.

Each mooring was supported by a single 37" (0.94m) diameter ORE float, yielding buoyancy in excess of 200 kg. The A and B moorings each supported two current meters, and the C and D moorings each supported three current meters. The vertical mooring design was similar to that given by Lee and Schutts (1977); a typical arrangement is shown in Fig. 4. The mooring coordinates, instrument start and stop times, instrument depths, and water depths are given in Table 1. The "winter" data set reported here spans the period from 16 January to 15 May 1979, or 120 days. Data from a similar experiment in the fall of 1979 will be presented in a future data report.

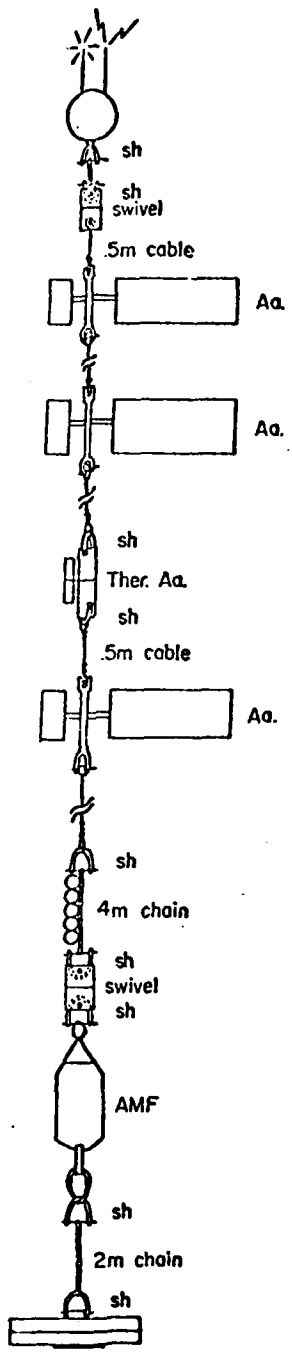


Figure 4. Typical mooring design, showing the position of Aanderaa current meters (Aa) in the wire held taut by a large main float and a train-wheel anchor. The C and D moorings also supported Aanderaa thermographs (Ther. Aa), but early thermistor string failures occurred in both cases. AMF (now EG&G) sea-link acoustic releases were used.

Table 1. Instrument identification, start and stop times, depths, and mooring locations.

Instr. name	Instrument no.	Instrument type	Reference no.	Coordinates	Water depth (m)	Instr. depth (m)	Sample interval (min)	Anchor deployment Start date (1979) Day-Mo.-Hr. (GMT)	Anchor release End date (1979) Day-Mo.-Hr. (GMT)	On time (GMT) (16 Jan 79)	Off time (GMT) (1979)
A TOP	3425	AA	655	Lat 33°27.96' Long 76°52.3'	198	98	20	16 Jan 0831	15 May 1030	0600	15 May 1118
A BOT	3343	AA	41		198	178	20			0600	15 May 1119
B TOP	3426	AA	622	Lat 33°21.46' Long 76°41.71'	390	250	20	16 Jan 1040	15 May 1258	0600	15 May 1342
B BOT	3423	AA	286		390	370	20			0600	15 May 1337
C TOP	3332	AA	500	Lat 33°50.75' Long 76°15.50	385	245	20	16 Jan 1532	15 May 1800	0600	16 May 2209
C MID	3345	AA	30		385	305	20			0600	16 May 2216
C BOT	3344	AA	624		385	365	20			0600	16 May 2217
D TOP	3337	AA	67	Lat 33°55.44' Long 76°11.57'	376	236	20	16 Jan 1718	15 May 2021	0600	16 May 2217
D MID	3427	AA	733		376	296	20			0600	16 May 2219
D BOT	3424	AA	840		376	356	20			0600	16 May 2220

1.3 SUPPORTING OBSERVATIONS

Hydrographic and other observations collected during the winter array launch and recovery operations were reported by Brooks *et al.* (1980). Most of the at-sea operations were conducted in R/V *Endeavor*. The moorings were recovered using R/V *John deWolfe*.

SECTION 2

Data Sources, Processing, and Basic Statistics

2.1 TRANSCRIPTION OF AANDERAA DATA TAPES

The raw data on Aanderaa magnetic tapes consist of a sequence of pulse width modulated (PCM) binary numbers. Two binary words are recorded for each sensor sampled, plus two words for an internal reference number. The binary PCM data tapes were read by a reel-to-reel tape deck, then transcribed to computer-compatible binary words by a hardware interface device built by Mr. Lawrence Ives of North Carolina State University. The decoded raw data consist of time series of numbers in the range of 0 to 1023 (decimal equivalent).

2.2 INSTRUMENT CALIBRATION

The ten Aanderaa RCM-4 recording current meters used in the Gulf Stream Meanders Experiment were subjected to calibration procedures for direction and temperature. The four meters which were positioned at the top of the moorings contained pressure sensors, which were also calibrated. The calibration values supplied by the manufacturer for speed and conductivity were used; no other laboratory calibration was performed for these variables. In this section the calibration procedures and results are presented, along with the manufacturer's calibration information. The calibration data, either measured or supplied by Aanderaa, were used to convert from the internally

recorded binary number, N, which ranges in decimal equivalent from 0 to 1023, into scientific units.

Speed

The conversion from N to speed, in cm/sec, was accomplished with the linear formula

$$\text{Speed} = 1.5 + 0.14\ N.$$

The values 1.5 and 0.14 were supplied by Aanderaa. A graph of this calibration relationship is given in Fig. 5.

Conductivity

Aanderaa calibration values for conductivity were used for all meters. The coefficients in the linear formula

$$\text{Conductivity (mmho/cm)} = A + BN$$

are listed in Table 2. Although slight differences in the coefficients exist among the meters, the graphs of conductivity vs. N all appear essentially the same; thus, Fig. 5 is applicable for all instruments.

Direction

Each RCM-4 compass was calibrated as follows: The instrument was mounted on a non-magnetic bracket located away from known magnetic interference. With the internal digitizing and recording mechanisms set to continuously record, the instrument was turned through 360°, indexing by ten degrees, allowing the compass to stablize at each position and to record at least six cycles of the direction reading. A cubic equation of the form

$$\text{Direction (magnetic)} = A + BN + CN^2 + DN^3$$

was fitted to the 36 calibration values. The coefficients A through D for each meter are listed in Table 2. The direction values from the cubic equation differed by less than one degree from the measured calibration values. Graphs

of the calibration curve and the Aanderaa curve for seven meters are shown in Fig. 6. Recording problems resulted in unuseable calibration information for meters 3423, 3332 and 3337, so the Aanderaa formula

$$\text{Direction (magnetic)} = 1.5 + 0.349\ N$$

was used for these instruments.

Temperature

All temperature sensors were calibrated as follows: With all meters sealed and recording at 15 minute intervals, they were immersed in an icewater bath. The ice was allowed to slowly melt, and then the water to warm to room temperature (~25°C). Stirring was provided throughout the warming period by two small pumps. Four independent Hewlett–Packard quartz–crystal thermometers were placed around the bath for temperature measurement. A continuous record (strip chart) of the temperature measured by one of the quartz sensors was made and used as the calibration standard. Temperature readings around the bath using the other three sensors showed the temperature differences to be always less than 0.05°C,[1] insuring that all meters were recording essentially the same temperature. Calibration temperatures at known times of RCM–4 recordings were compared with the corresponding recorded values of N. A number (*ca.* 15 to 19) of Temperature–N pairs were used to determine the best fit to the cubic equation:

$$\text{Temperature (°C)} = A + BN + CN^2 + DN^3$$

The coefficients A through D are listed for each meter in Table 2, along with the coefficients supplied by Aanderaa. The difference between the temperature calibration values computed from the cubic equation and those directly measured was in all cases less than the stated accuracy of the temperature sensor (0.15 °C). Graphs of Temperature vs. N are given for 9

[1] After all ice had melted.

instruments in Fig. 7. Recording problems during the bath calibration in instrument number 3423 did not permit the construction of a calibration curve; thus, the Aanderaa coefficients were used for the field data conversion for this meter.

Pressure

The pressure transducers on instruments 3425, 3426, 3332 and 3337 were calibrated using a manual hydraulic pump. Calibration data were collected in the range 0 to 500 PSIG at intervals of 50 PSIG. These points were fitted to the cubic equation

$$\text{Pressure (PSIG)} = A + BN + CN^2 + DN^3.$$

The coefficients in the cubic equation for each meter are listed in Table 2, along with the Aanderaa coefficients. Graphs of Pressure vs. N for the four meters are shown in Fig. 8. The calibration curve departs from the Aanderaa curve for values of pressure greater than 500 PSIG, because the highest pressure used in the calibration curve-fitting procedure was 500 PSIG. Since the highest pressures encountered *in situ* did not exceed 500 PSIG the upper part of the pressure calibration curves in Fig. 8 were not used and should be ignored.

Salinity

Salinity values were calculated from the temperature and conductivity time series in scientific units as follows: The conductivity that seawater with a salinity of 35 ‰ would have at the measured temperature was calculated using the formula

$$\text{Cond}(T, 35) = 29.01067 + 0.8677579\,T + 0.4074545\times10^{-2}\,T^2 - 0.1437152\times10^{-4}\,T^3,$$

where T is the measured temperature (°C) and Cond is in mmho/cm. This formula is the best-fit cubic equation calculated from information presented by Weyl (1964). The conductivity ratio at the measured temperature was calculated by

$$R_T = \text{Cond (meas)} / \text{Cond (T, 35)},$$

where Cond (meas) is the measured conductivity in mmho/cm. The difference, Δ_{15}, between the conductivity ratio at 15°C and R_T was calculated with the formula (National Institute of Oceanography of Great Britain and Unesco, 1971)

$$\Delta_{15} = 10^{-5} R_T (R_T - 1) (T-15) [96.7 - 72.0 R_T + 37.3 R_T^2 - (0.63 + 0.21 R_T^2) (T-15)].$$

The salinity in parts per thousand was then calculated using the formula (*ibid.*)

$$S(‰) = -0.08996 + 28.29720 R_{15} + 12.80832 R_{15}^2 - 10.67869 R_{15}^3 + 5.98624 R_{15}^4 - 1.32311 R_{15}^5,$$

where $R_{15} = R_T + \Delta_{15}$.

Table 2. Aanderaa–supplied (Aa) and calibration–produced (Cal) coefficients for the conversion of recorded binary numbers to scientific units. The general formula $V = A + BN + CN^2 + DN^3$ was used, where V is the variable, and N is decimal equivalent (0 – 1023) of the recorded binary number.

Meter No. \ Variable		Speed (cm sec^{-1})		Direction (degrees mag)		Conductivity (mmho cm^{-1})		Temperature (°C)		Pressure (kg cm^{-2})	(PSI)
		Aa	Cal	Aa	Cal	Aa	Cal	Aa	Cal	Aa	Cal
3332	A	1.5		1.5	No calibration data	0		-0.885	-0.4144	-4.36507	-53.4979
	B	0.14		0.349		0.07593		0.03587	0.0361	0.0770611	1.1150
	C							-0.8388×10^{-5}	-0.8734×10^{-5}		-0.2231×10^{-3}
	D							0.4300×10^{-8}	0.4470×10^{-8}		0.3127×10^{-6}
3337	A	1.5		1.5	No calibration data	0.076		-0.3905	-0.3128	-3.78849	-67.9111
	B	0.14		0.349		0.07607		0.03587	0.0375	0.0758634	1.3185
	C							-0.8388×10^{-5}	-0.1230×10^{-5}		-0.5934×10^{-3}
	D							0.4300×10^{-8}	0.6655×10^{-8}		0.9220×10^{-6}
3343	A	1.5		1.5	- 9.9327	-0.084		-0.9103	-0.3176		
	B	0.14		0.349	0.3904	0.07593		0.03587	0.0375		
	C				-0.8870×10^{-4}			-0.8388×10^{-5}	-0.1260×10^{-5}		
	D				0.4451×10^{-7}			0.4300×10^{-8}	0.6858×10^{-8}		
3344	A	1.5		1.5	-10.9572	-0.084		-0.0905	-0.2421		
	B	0.14		0.349	0.4032	0.07593		0.03587	0.0372		
	C				-1.1658×10^{-4}			-0.8388×10^{-5}	-0.1226×10^{-5}		
	D				0.6087×10^{-7}			0.4300×10^{-8}	0.7004×10^{-8}		
3345	A	1.5		1.5	- 6.3311	0.076		-0.0773	-0.2877		
	B	0.14		0.349	0.3514	0.07597		0.03587	0.0367		
	C				0.0054×10^{-4}			-0.8388×10^{-5}	-0.1044×10^{-5}		
	D				-0.0469×10^{-7}			0.4300×10^{-8}	0.5516×10^{-8}		
3423	A	1.5		1.5	No calibration data	0		-0.9511	No calibration data		
	B	0.14		0.349		0.07574		0.03587			
	C							-0.8388×10^{-5}			
	D							0.4300×10^{-8}			
3424	A	1.5		1.5	- 4.8337	0		-0.8781	-0.079		
	B	0.14		0.349	0.3653	0.07650		0.03587	0.0386		
	C				-0.4181×10^{-4}			-0.8388×10^{-5}	-0.1790×10^{-5}		
	D				0.2383×10^{-7}			0.4300×10^{-8}	1.1579×10^{-8}		
3425	A	1.5		1.5	- 2.7682	0.07574		-0.8651	-0.2713	-3.92234	-65.2533
	B	0.14		0.349	0.3460	0.07574		0.03587	0.0377	0.0757081	1.2345
	C				-0.0683×10^{-4}			-0.8388×10^{-5}	-1.3034×10^{-5}		-0.5164×10^{-3}
	D				0.0824×10^{-7}			0.4300×10^{-8}	0.7184×10^{-8}		0.5034×10^{-6}
3426	A	1.5		1.5	- 3.1920	0		-0.8827	-0.2922	-4.20412	-72.1725
	B	0.14		0.349	0.3571	0.07598		0.03587	0.0375	0.0761238	1.3555
	C				-0.2174×10^{-4}			-0.8388×10^{-5}	-1.2131×10^{-5}		-1.0377×10^{-3}
	D				0.1214×10^{-7}			0.4300×10^{-8}	0.6462×10^{-8}		1.0679×10^{-6}
3427	A	1.5		1.5	- 3.1797	0.07612		-0.9121	-0.3606		
	B	0.14		0.349	0.3330	0.07612		0.03587	0.0380		
	C				0.3754×10^{-4}			-0.8388×10^{-5}	-1.3525×10^{-5}		
	D				-0.2328×10^{-7}			0.4300×10^{-8}	0.7438×10^{-8}		

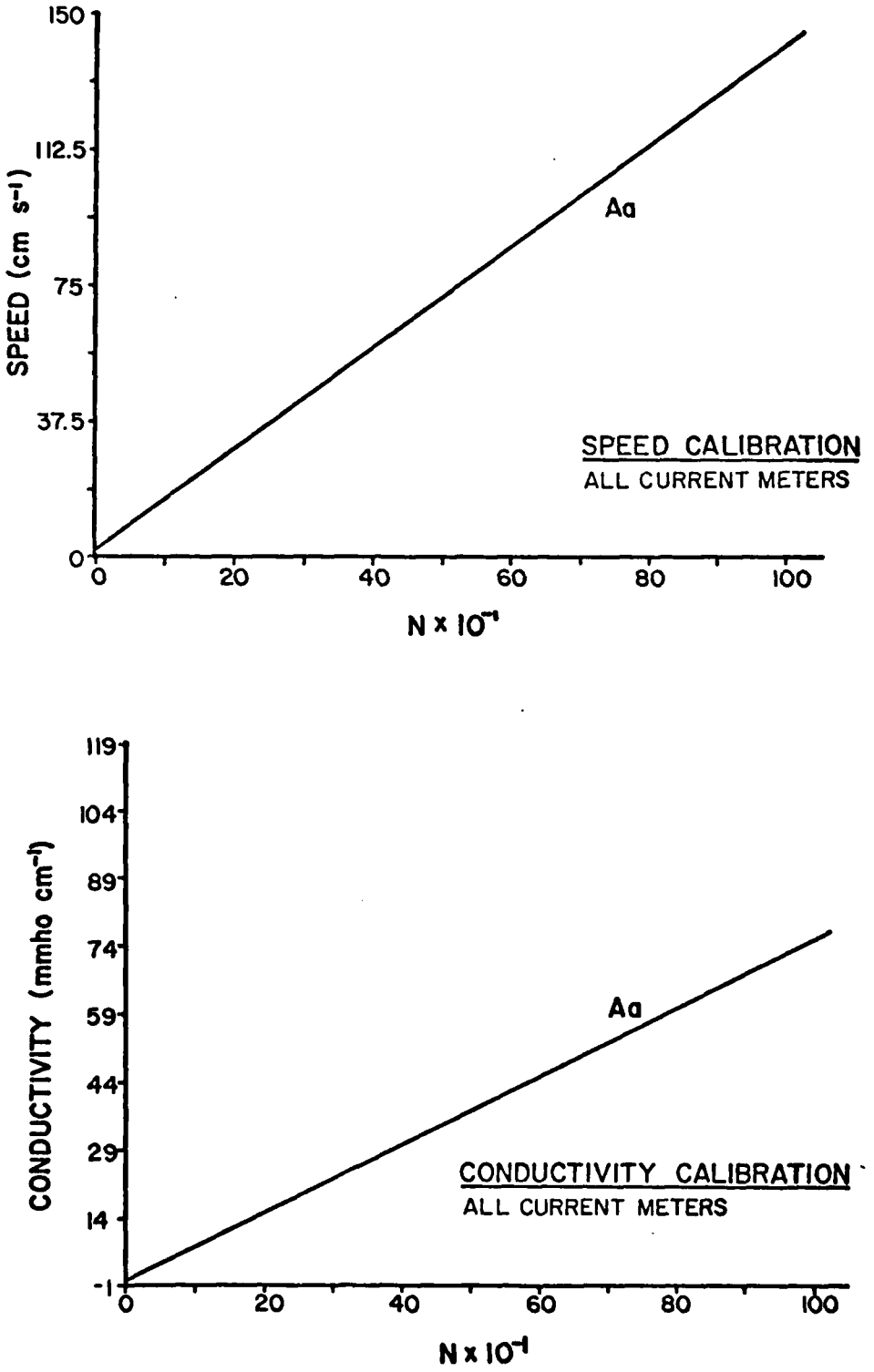
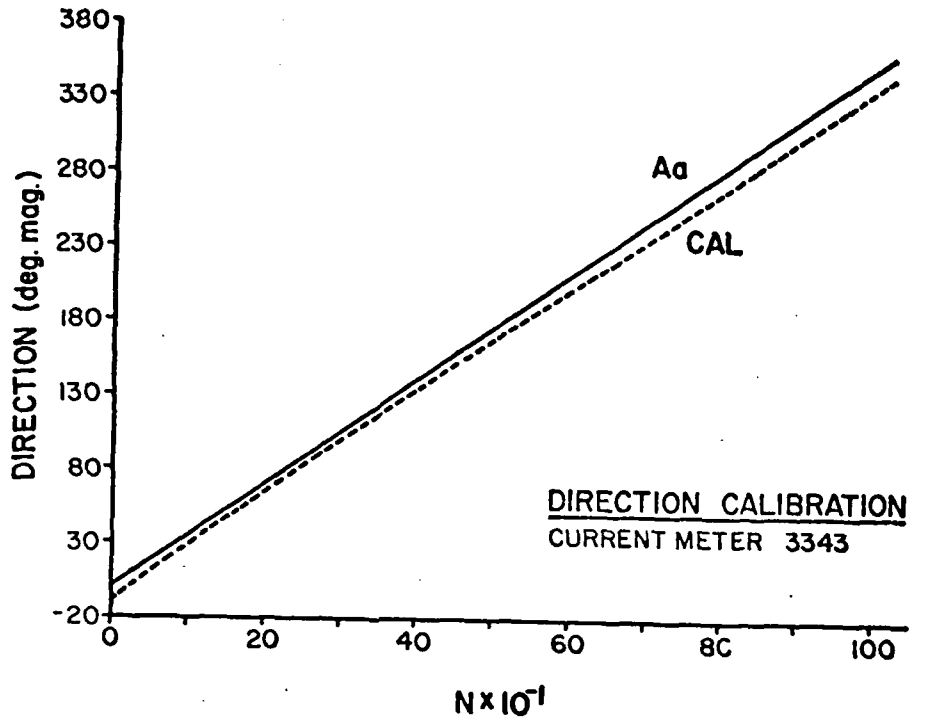


Figure 5. Speed and conductivity calibration graphs, using the cubic coefficients supplied by Aanderaa (Aa), which were applied to all instruments.



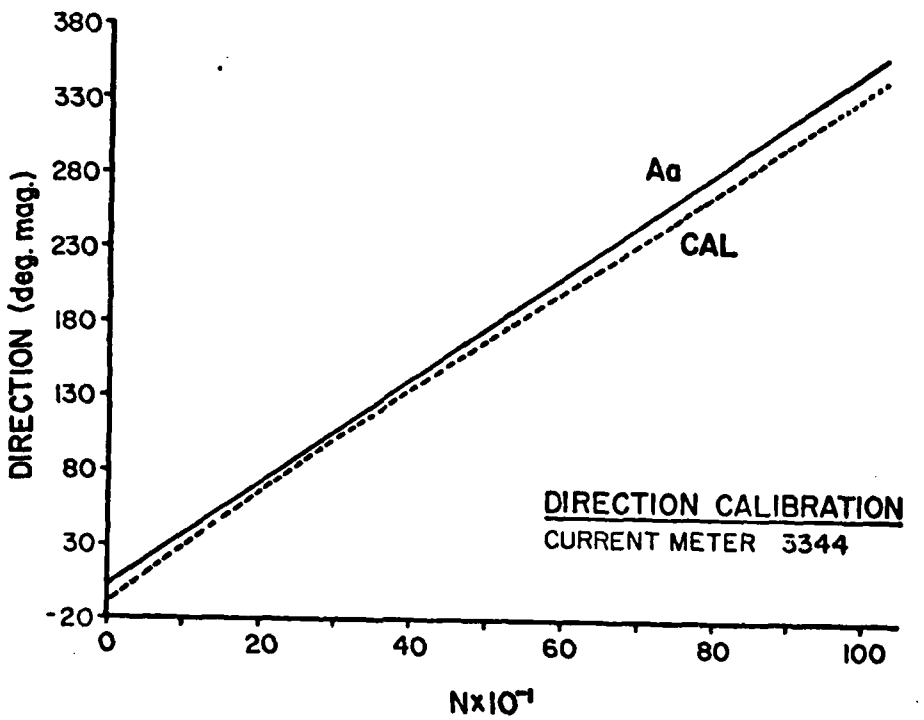
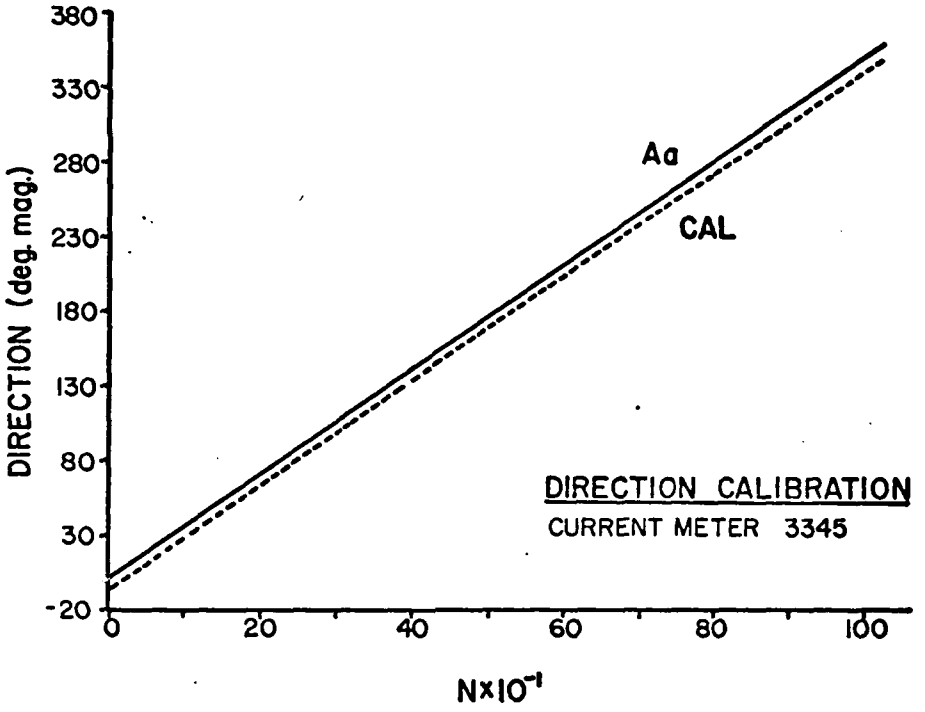


Figure 6. Calibration curves for compass direction, based on coefficients supplied by Aanderaa (–) and coefficients based on directly measured calibration data (– – – –). The latter were used for calibration of all instruments except numbers 3423, 3332 and 3337.


380
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-20
DIRECTION (deg. mag.)
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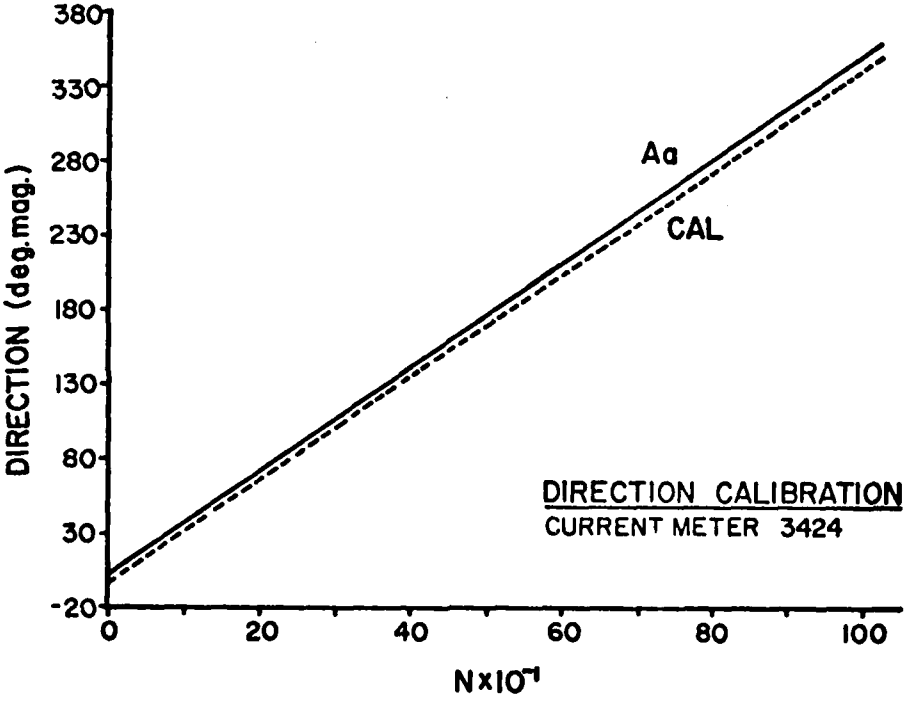
CAL
DIRECTION CALIBRATION
CURRENT METER 3345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DIRECTION (deg. mag.)
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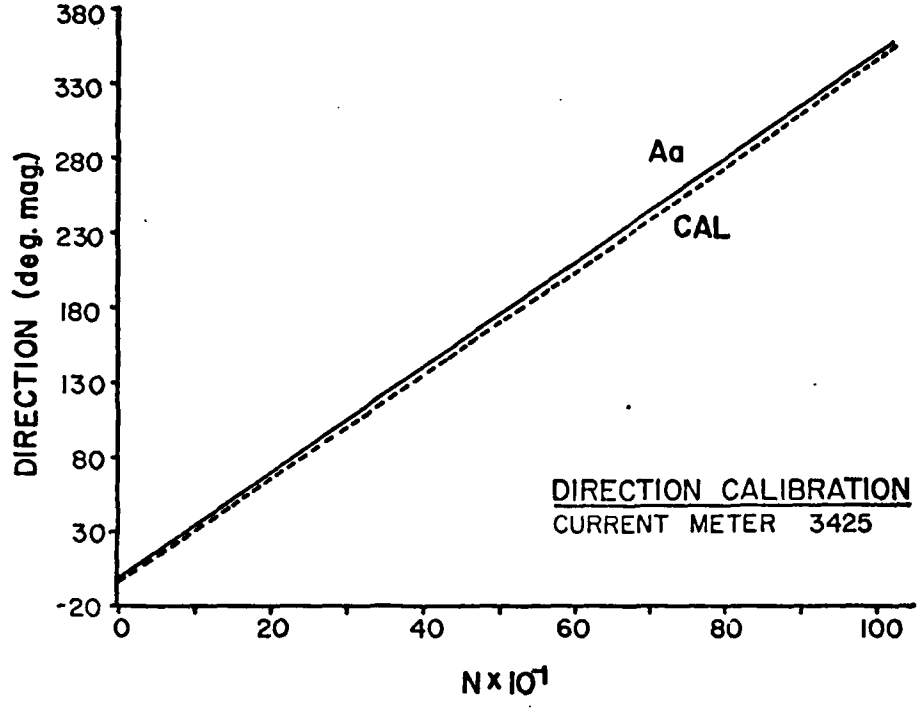
DIRECTION CALIBRATION
CURRENT METER 3424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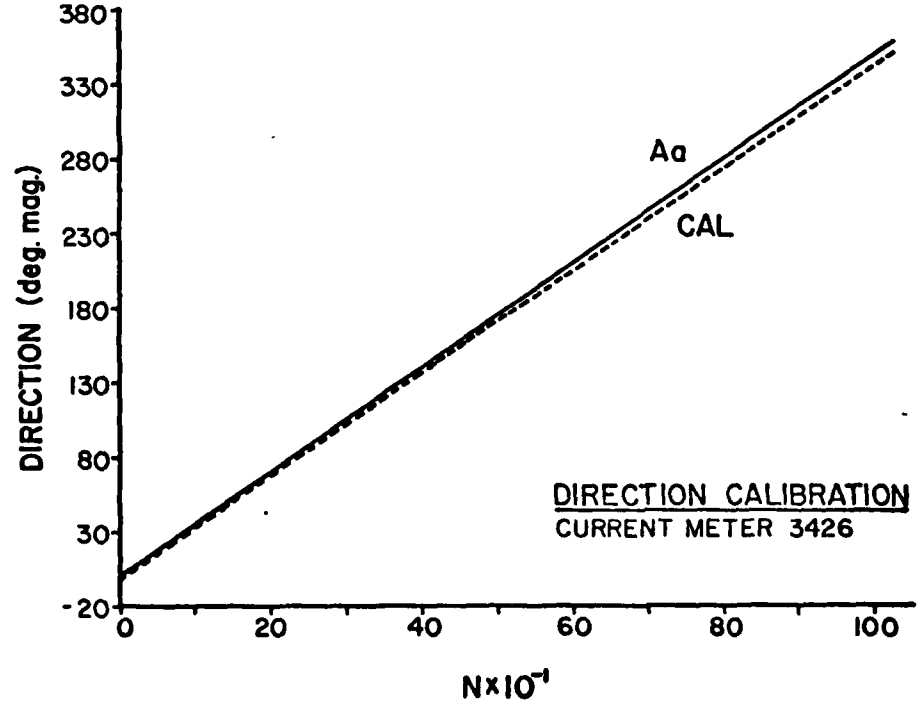
DIRECTION CALIBRATION
CURRENT METER 3425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-20
DIRECTION (deg. mag.)
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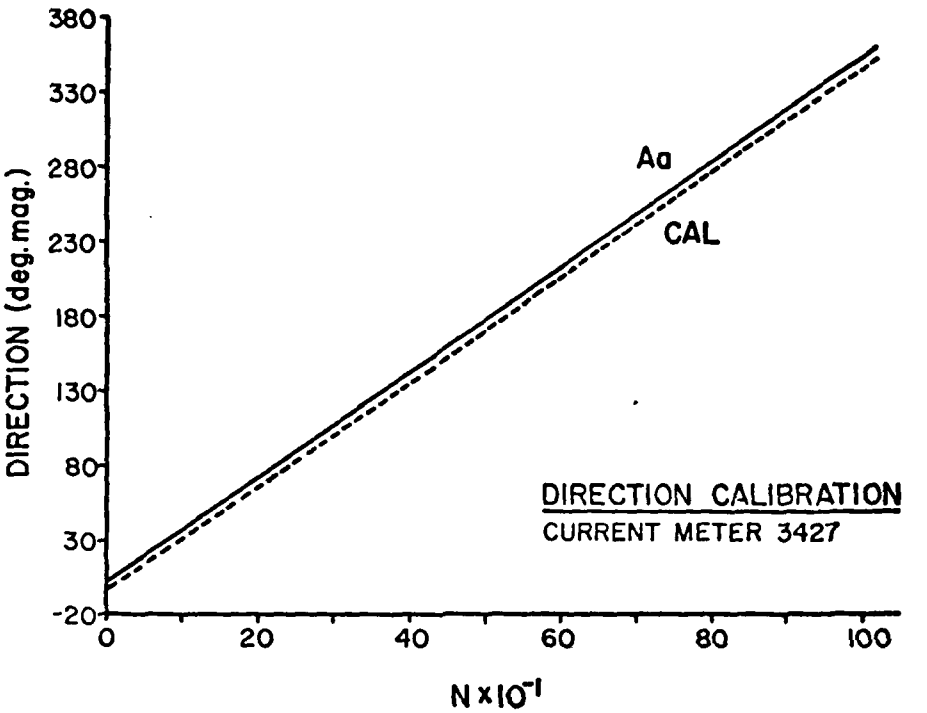
DIRECTION CALIBRATION
CURRENT METER 3426


380
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180
130
80
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-20
DIRECTION (deg.mag.)
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20
40
60
80
100
N x 10⁻¹
Aa
CAL
DIRECTION CALIBRATION
CURRENT METER 3427

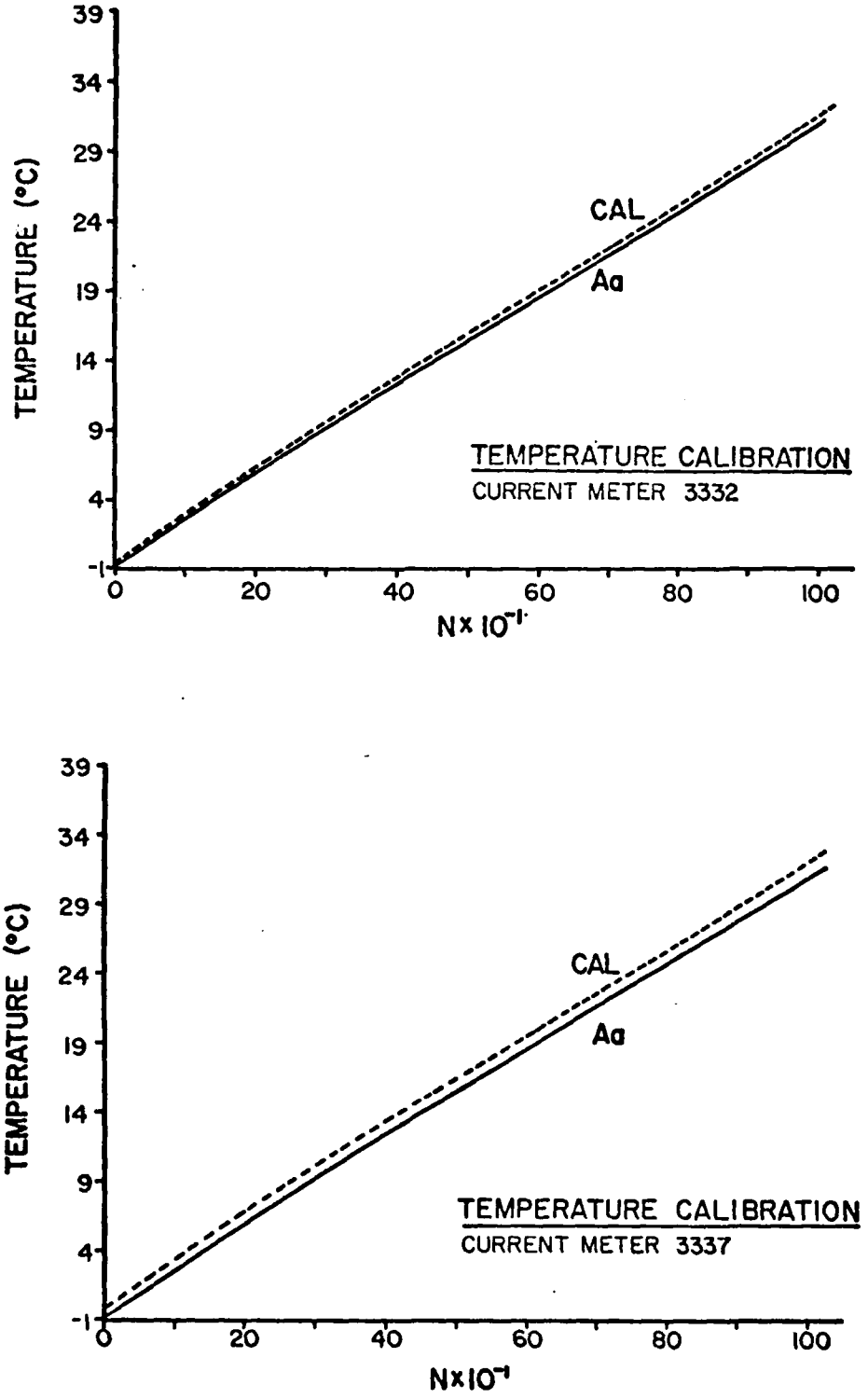
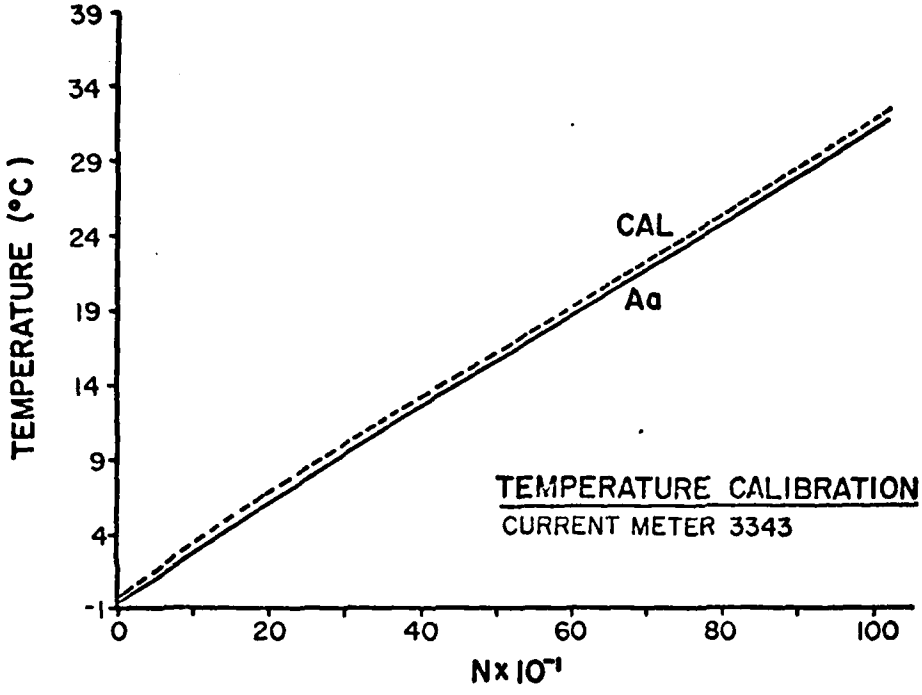


Figure 7. Calibration curves for temperature, based on coefficients supplied by Aanderaa (–), and coefficients based on directly measured calibration data (----). The latter were used for calibration of all instruments.


39
34
29
24
19
14
9
4
-1
TEMPERATURE (°C)
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3343
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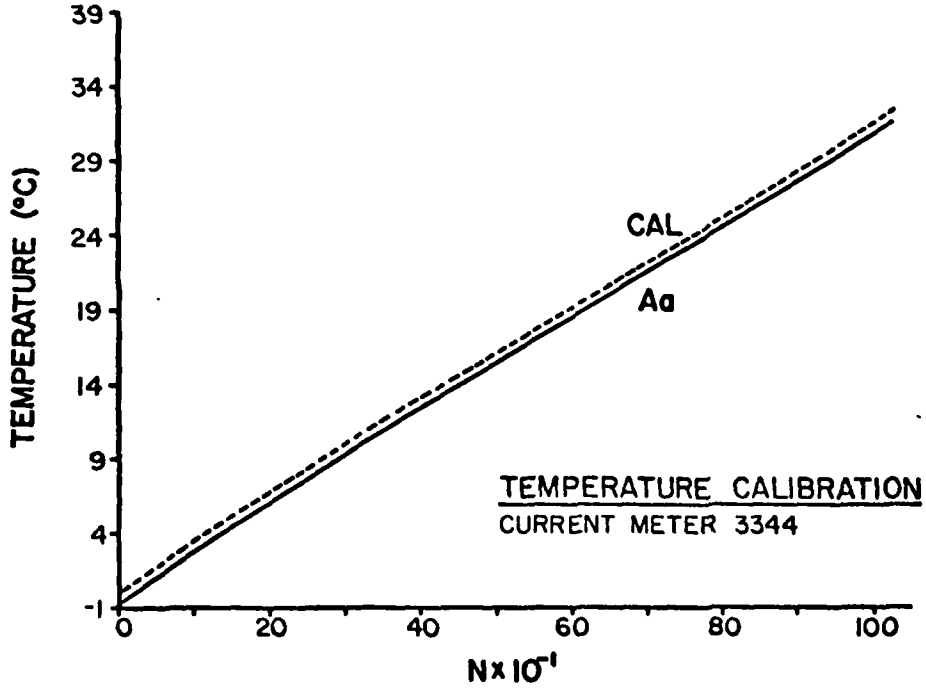
20
40
60
80
100
N x 10⁻¹


39
34
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19
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9
4
-1
TEMPERATURE (°C)
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3344
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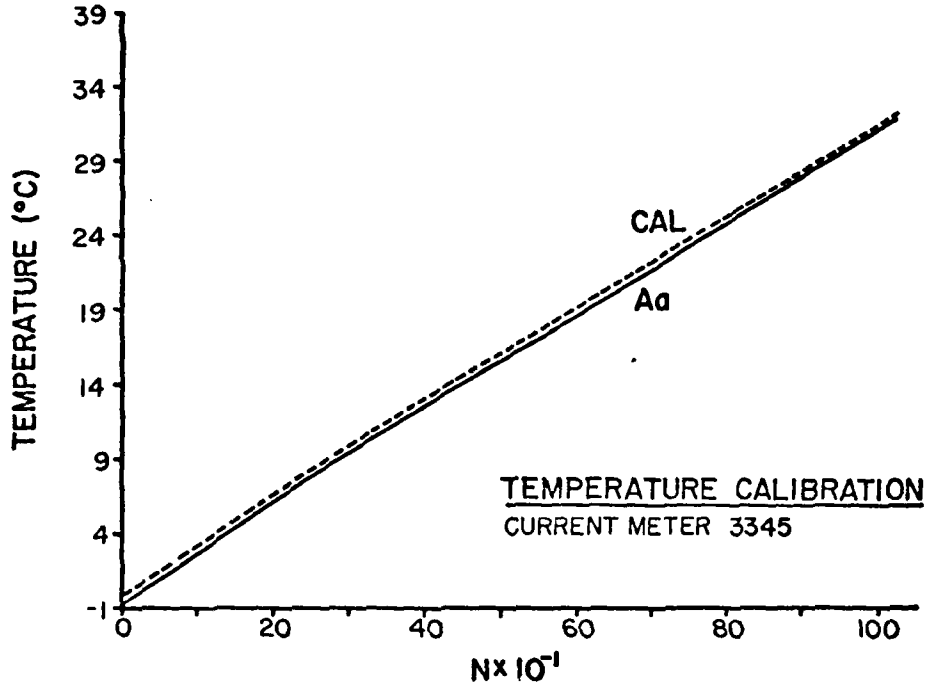
20
40
60
80
100
N x 10⁻¹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34
29
24
19
14
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4
-1
TEMPERATURE (°C)
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3345
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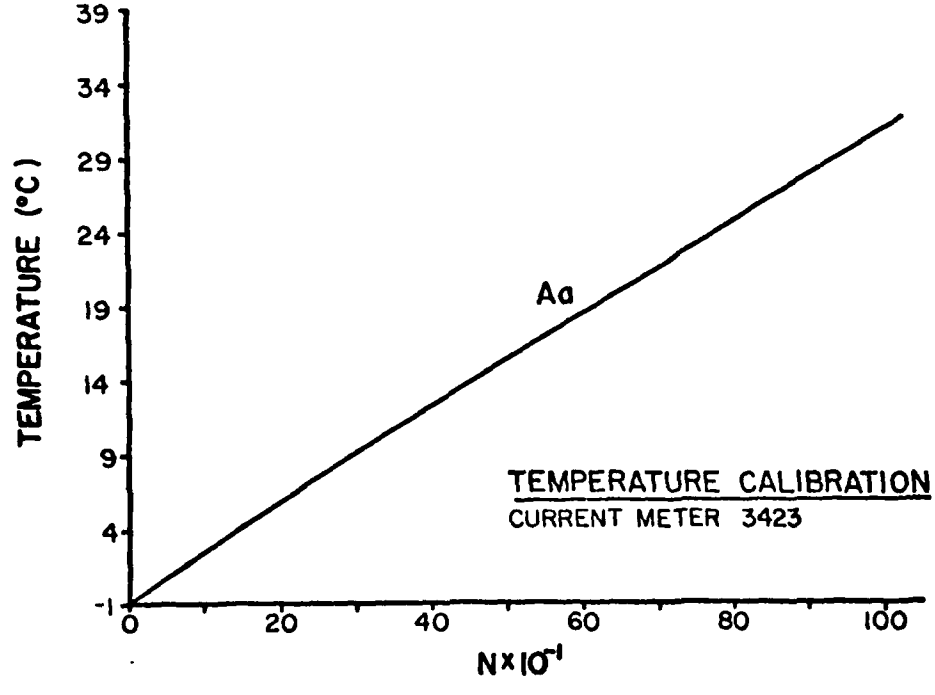
20
40
60
80
100
N x 10⁻¹


39
34
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19
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9
4
-1
TEMPERATURE (°C)
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3423
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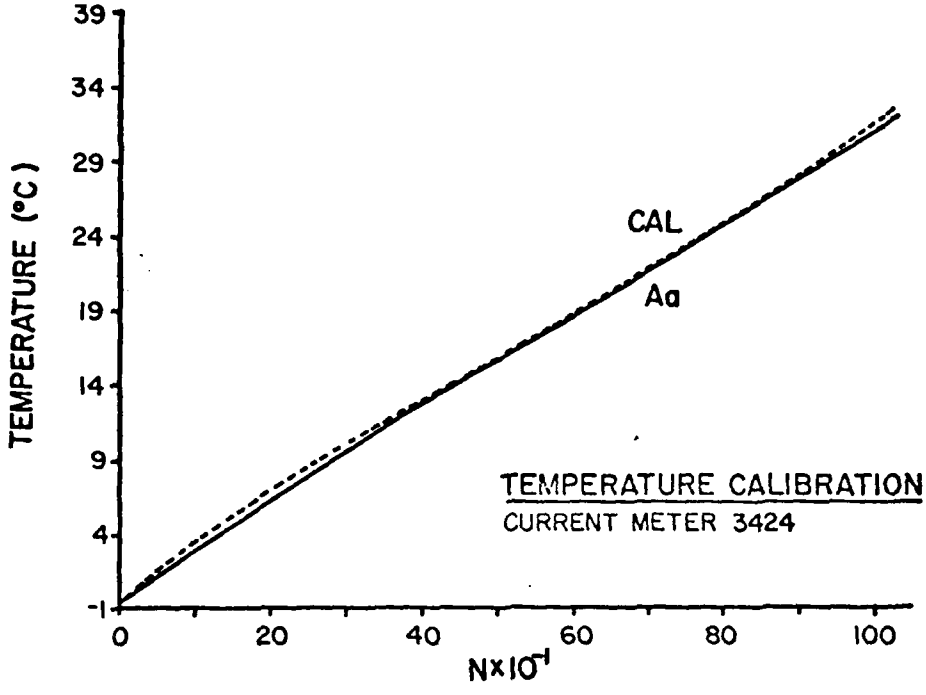
20
40
60
80
100
N x 10⁻¹


TEMPERATURE (°C)
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34
29
24
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-1
0
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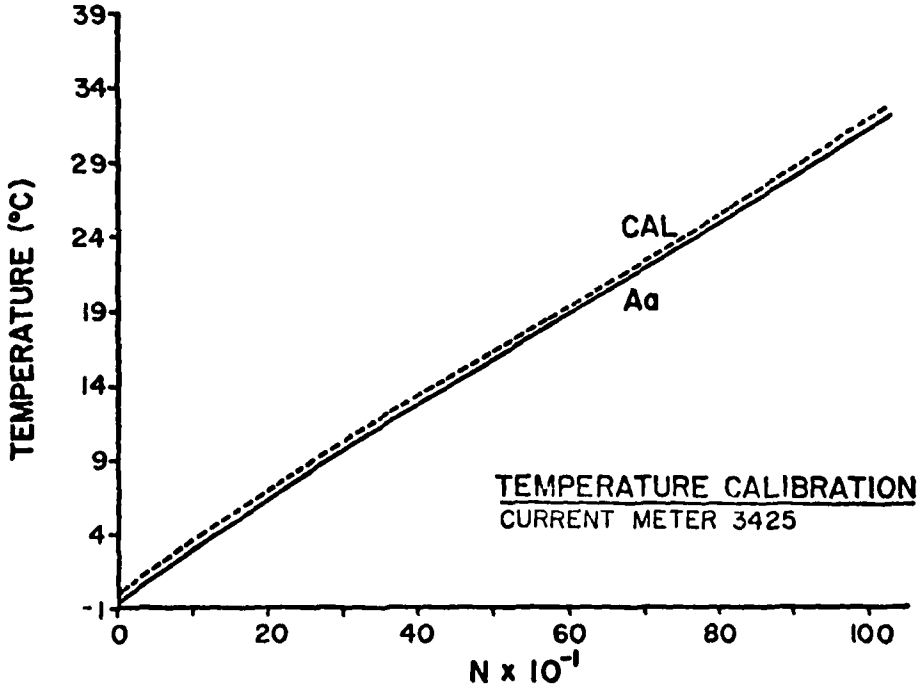
40
60
80
100
N×10⁻¹
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3424


TEMPERATURE (°C)
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0
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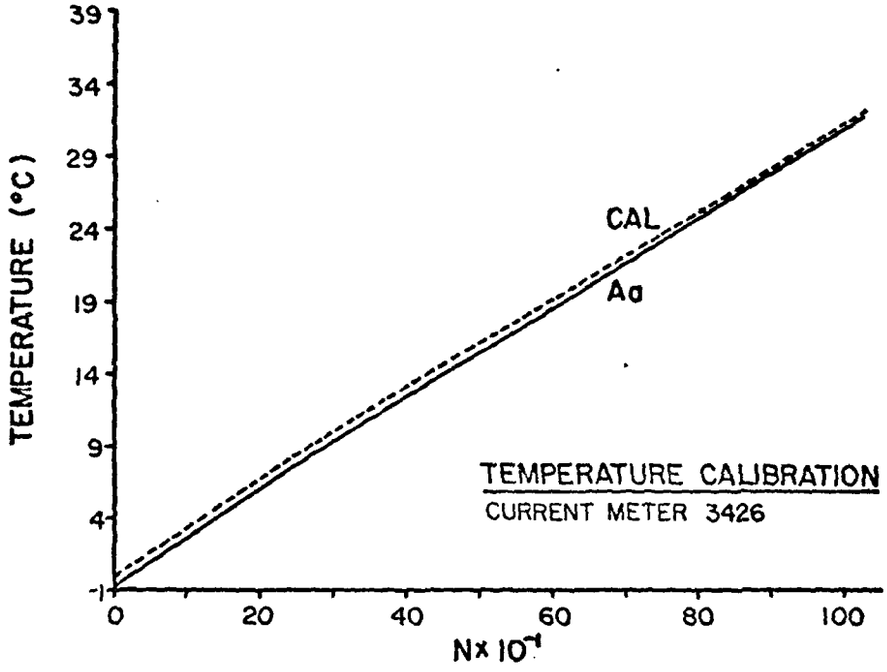
100
N x 10⁻¹
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3425


TEMPERATURE (°C)
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34
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24
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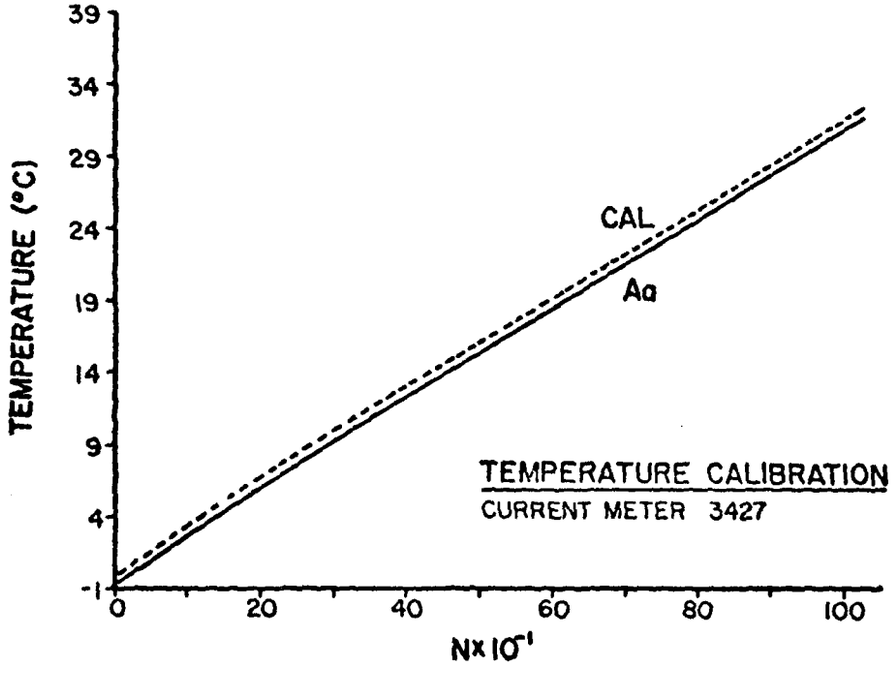
14
9
4
-1
0
20
40
60
80
100
N x 10⁻¹
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3426


TEMPERATURE (°C)
39
34
29
24
19
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-1
0
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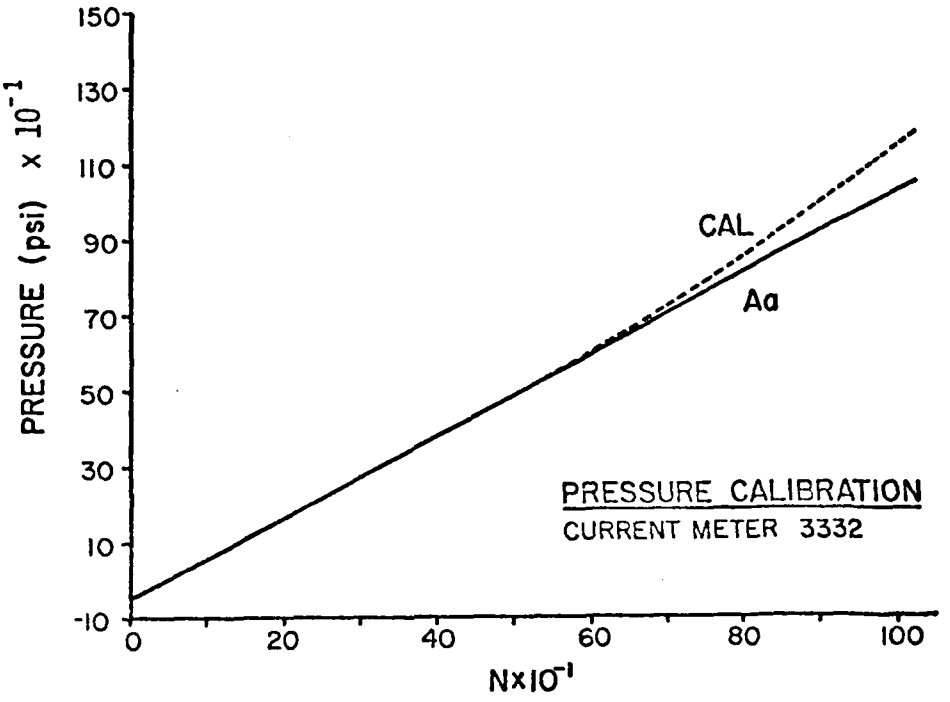
40
60
80
100
N x 10⁻¹
CAL
Aa
TEMPERATURE CALIBRATION
CURRENT METER 3427



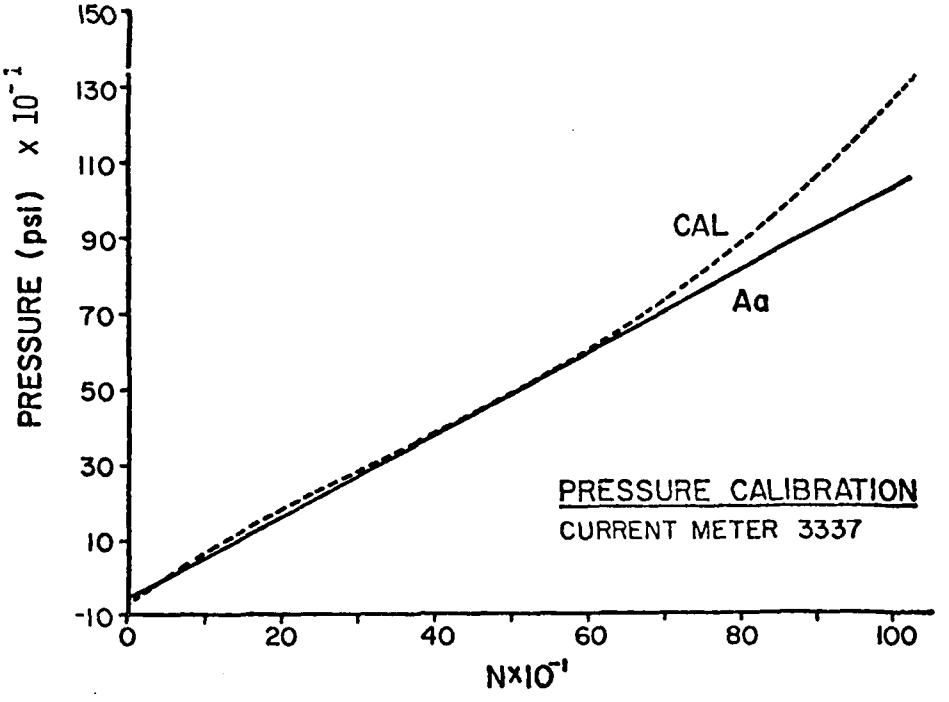
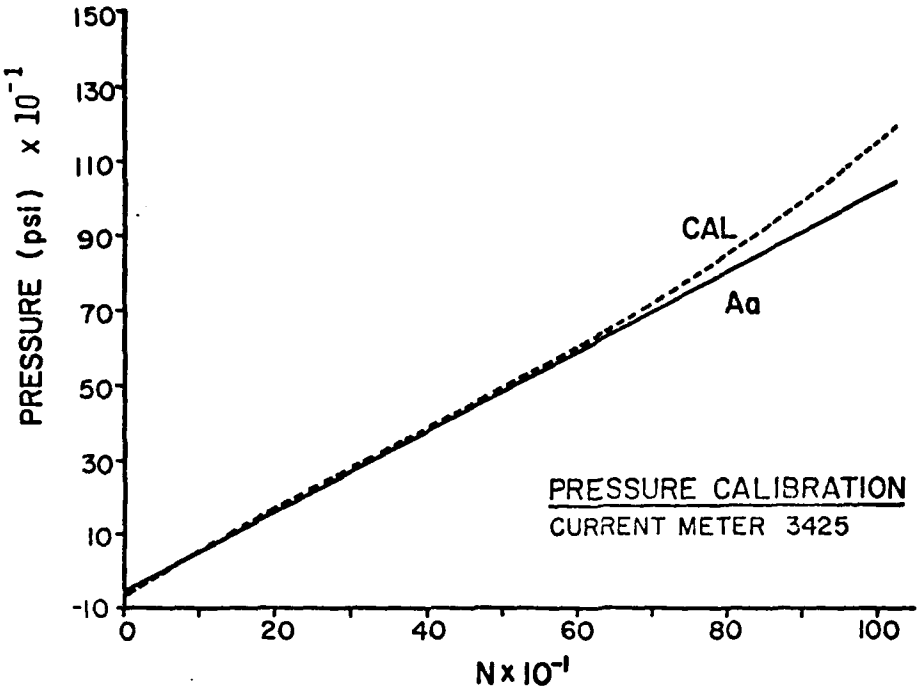
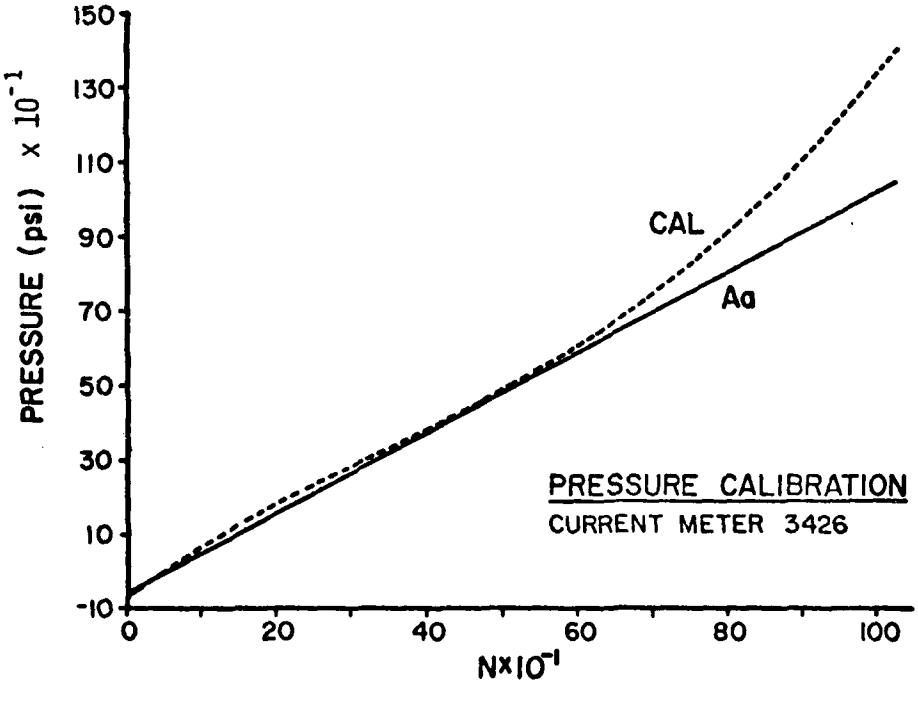


Figure 8. Calibration curves for pressure, based on coefficients supplied by Aanderaa (–) and coefficients based on directly measured calibration data (– – – –) over the range 0 to 500 PSIG. The two curves diverge and were not used for pressures higher than 500 PSIG because of the curve-fitting process. The highest *in-situ* pressures were less than 500 PSIG.


PRESSURE (psi) x 10^{-1}
150
130
110
90
70
50
30
10
-10
0
20
40
60
80
100
N x 10^{-1}
CAL
Aa
PRESSURE CALIBRATION
CURRENT METER 3425


PRESSURE (psi) x 10^{-1}
150
130
110
90
70
50
30
10
-10
0
20
40
60
80
100
N x 10^{-1}
CAL
Aa
PRESSURE CALIBRATION
CURRENT METER 3426

2.3 AANDERAA DATA EDITING

The calibrated Aanderaa data files were machine-edited for extreme values exceeding reasonable upper and lower bounds on each variable. Bad points were replaced by values linearly interpolated between the preceeding and succeeding good points. The data were then plotted, and further editing of unreasonable values was done by operating on the data files interactively using a computer terminal. All edited points were replaced by interpolated values, as in the machine-edited case.

2.4 ANCILLARY DATA SOURCES

Sea level height from tide gages at Southport and Beaufort (near Morehead City), Fig. 3, and atmospheric surface observations at Cape Hatteras and at NDBO moored buoy number 41004, Fig. 1, were obtained from the National Archives for the winter array period. The Hatteras atmospheric data shown here are wind velocity vector components, air temperature, and atmospheric pressure. In addition, the wind stress vector components were computed, using a constant drag coefficient $C_D = 1.5\times10^{-3}$. The NDBO buoy (NDBO-4 on Fig. 1) was located at 32.6°N, 78.7°W, approximately on the 100 m isobath, several hundred km upstream from our array area. The NDBO data presented are wind velocity vector components, air and sea surface (water) temperatures, and atmospheric pressure. The NDBO wind stress components are also shown. The sea level height data shown here have been corrected for static barometric pressure changes by adding 1.01 cm to sea level height for each mb of atmospheric pressure increase relative to its mean at the nearest atmospheric station (Wilmington for Southport and Cape Hatteras for Beaufort).

2.5 DATA PROCESSING

The raw, calibrated data from the current meters consisted of time series of current speed and direction, temperature, salinity, and (only for top instruments) pressure. The basic sampling interval for all current meters was 20 minutes. Current speed and direction were converted to (u, v) vector velocity components in an (offshore, downstream) coordinate frame rotated clockwise 34 degrees from true north to align with the 400 m isobath. The same coordinate frame was used for all vector data sets, which facilitates direct comparison between them.

Standard digital filtering techniques based on the FESTSA time series analysis system (Brooks, 1976) were used to subdivide the frequency domain of the data sets. First, a 3-hour low pass filter (3 HRLP) was applied to reduce sampling noise and possible aliasing. Then a 40-hour low pass filter (40 HRLP) was applied to separate the daily and semidaily tidal and inertial motions from those with periods of several days and longer. For both filters, the specified cutoff period is the period at which the filter energy response is 0.25 times its long period response (-6db point). A Lanczos taper was used in each case, and the smoothed response function of the 40 HRLP filter is shown in Fig. 9. The response at the semidaily (dominant) tidal period is less than 10^{-7}. In addition, a 3 to 40 hours bandpass (3-40 HRBP) data set was obtained by subtracting the 40 HRLP set from the 3 HRLP set. The final sample interval was 1 hour for the 3 HRLP and 3-40 HRBP sets and 6 hours for the 40 HRLP set.

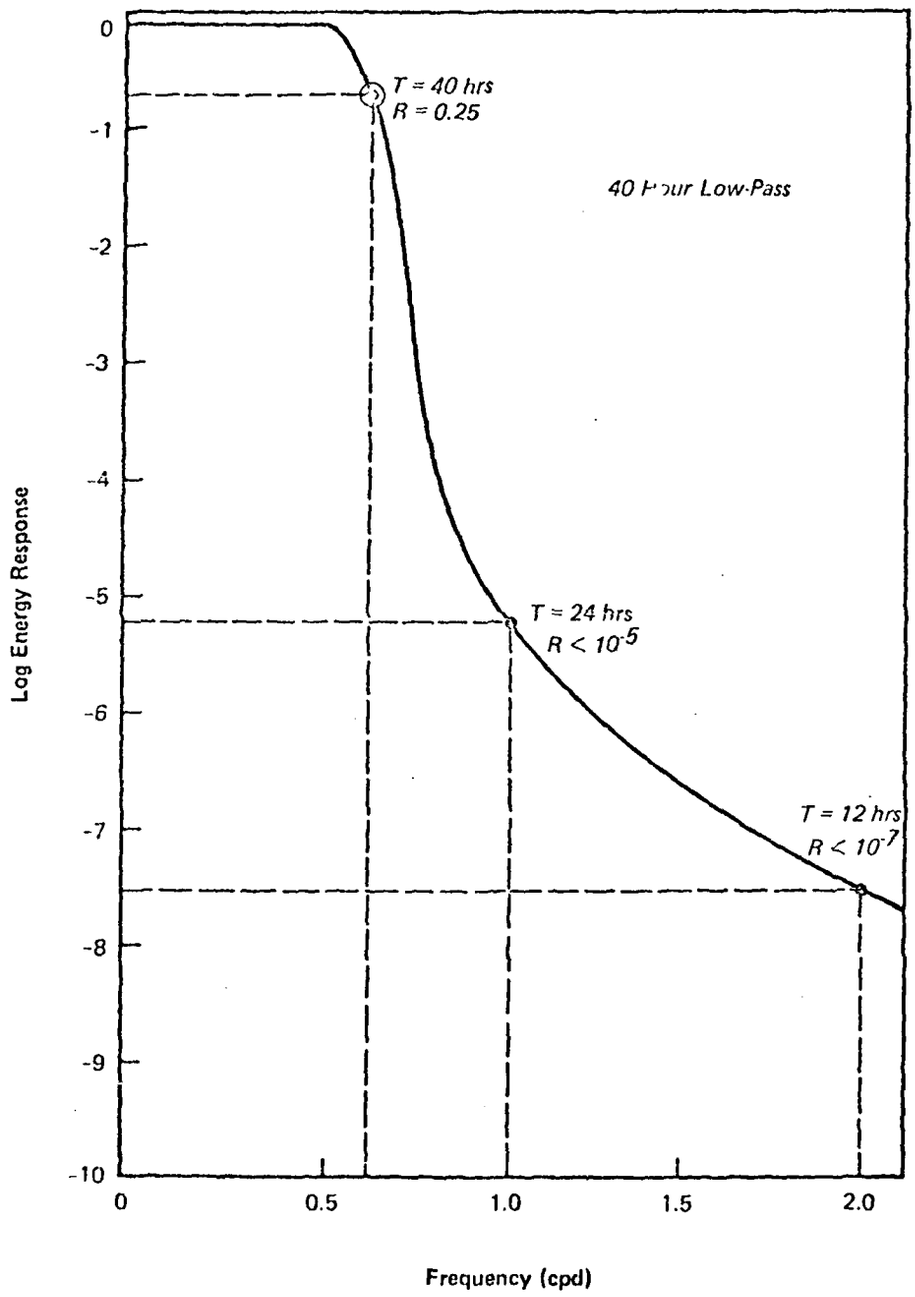


Figure 9. Response function for the 40 hour low pass Lanczos filter.

2.6 BASIC STATISTICS OF THE CURRENT METER DATA SET

First order and variance statistics for u, v, and T (temperature) from each current meter are shown in Table 3. Table 4 shows the variance ratios 3–40 HRBP/3 HRLP and 40 HRLP/3 HRLP, which approximately represent the division of total spectrum energy between the tidal–inertial band and the long period band, respectively. Departure of their sum from unity for each variable is a measure of filtering imperfection. The tidal–inertial band motions were strongest in the cross–shelf (u) component, particularly at the deepest instruments. The downstream (v) component fluctuations predominantly had periods of several days and longer.

Table 3. First-order and variance statistics of temperature (T) and velocity components (u, v) from each instrument, shown from 3 HRLP, 3–40 HRLP, and 40 HRLP filtered data sets.

3 HRLP

Current meter	Parameter	N	Min	Max	Mean	SD	Var
A TOP	T	2842	12.5	23.8	17.2	1.8	3.2
	U	2842	-38.6	48.8	0.2	9.8	96.0
	V	2842	-70.6	116.8	7.0	33.9	1149.2
A BOT	T	2842	3.9	19.5	11.5	3.3	10.9
	U	2842	-31.5	44.4	-2.7	9.1	82.8
	V	2842	-58.5	74.7	4.0	21.0	441.0
B TOP	T	2842	8.8	18.7	12.6	2.5	6.3
	U	2842	-55.6	63.8	1.3	15.7	246.5
	V	2842	-49.5	134.0	25.1	29.3	858.5
B BOT	T	2842	6.2	14.4	8.9	1.5	2.3
	U	2842	-33.6	39.5	2.3	11.0	121.0
	V	2842	-62.6	53.4	4.7	17.3	299.3
C TOP	T	2837	9.2	18.1	12.8	2.1	4.4
	U	2837	-33.2	54.3	4.3	11.5	133.2
	V	2837	-44.0	135.1	32.3	33.6	1143.3
C MID	T	2532	3.2	29.5	11.2	1.8	3.2
	U	2661	-98.8	83.2	-0.2	16.1	259.2
	V	2661	-45.7	112.6	22.9	26.6	707.6
C BOT	T	2842	7.2	14.4	9.4	1.1	1.2
	U	2842	-33.4	48.0	-0.5	9.5	90.3
	V	2842	-39.8	74.4	9.3	19.8	392.0
D TOP	T	2823	8.5	18.8	13.2	2.0	4.0
	U	1655	-28.1	48.2	4.0	10.2	104.0
	V	1655	-34.9	121.6	31.5	28.7	841.0
D MID	T	2842	7.6	19.0	11.3	1.7	2.9
	U	2842	-29.5	41.9	-1.3	8.8	77.4
	V	2842	-46.0	116.0	24.3	28.8	829.4
D BOT	T	2842	6.7	13.6	9.3	1.1	1.2
	U	2842	-26.9	34.8	0.1	7.8	60.8
	V	2842	-38.2	55.1	7.9	16.8	282.2

3-40 HRBP

Current meter	Parameter	N	Min	Max	Mean	SD	Var
A TOP	T	2650	-3.9	3.1	0.0	0.5	0.3
	U	2650	-41.6	33.9	0.0	7.3	53.3
	V	2650	-28.1	37.2	0.0	8.2	67.2
A BOT	T	2650	-7.6	8.0	0.0	1.1	1.2
	U	2650	-37.5	37.9	0.0	7.4	54.8
	V	2650	-29.9	39.1	0.0	6.7	44.9
B TOP	T	2650	-1.9	2.3	0.0	0.4	0.2
	U	2650	-29.5	28.4	0.0	6.6	43.6
	V	2650	-33.7	27.2	0.0	7.2	51.8
B BOT	T	2650	-1.9	3.4	0.0	0.3	0.1
	U	2650	-24.4	23.8	0.0	6.3	39.7
	V	2650	-20.4	18.1	0.0	5.2	27.0
C TOP	T	2645	-2.2	2.0	0.0	0.4	0.2
	U	2645	-26.8	32.7	0.0	6.4	40.7
	V	2645	-27.1	35.6	0.0	7.1	51.0
C MID	T	2340	-1.9	4.5	0.0	0.5	0.3
	U	2469	-65.5	31.2	0.0	6.9	47.6
	V	2469	-25.5	63.7	0.0	6.8	46.2
C BOT	T	2650	-2.2	4.1	0.0	0.5	0.3
	U	2650	-29.2	35.8	0.0	8.3	68.9
	V	2650	-21.5	26.0	0.0	6.2	38.4
D TOP	T	2631	-3.1	4.8	0.0	0.6	0.4
	U	1463	-28.4	28.1	0.0	6.2	38.4
	V	1463	-27.2	29.2	0.0	7.3	53.3
D MID	T	2650	-2.1	3.7	0.0	0.5	0.3
	U	2650	-21.5	22.8	0.0	5.8	33.6
	V	2650	-21.9	27.6	0.0	6.5	42.3
D BOT	T	2650	-2.3	2.6	0.0	0.4	0.2
	U	2650	-28.6	30.7	0.0	6.9	47.6
	V	2650	-22.1	23.4	0.0	5.4	29.2

40 HRLP

Current meter	Parameter	N	Min	Max	Mean	SD	Var
A TOP	T	442	13.4	22.8	17.1	1.7	2.9
	U	442	-24.2	19.6	0.1	6.5	42.3
	V	442	-58.1	102.6	5.7	32.4	1049.8
A BOT	T	442	46.5	16.9	11.6	3.0	9.0
	U	442	-19.5	10.1	-2.6	5.0	25.0
	V	442	-42.4	61.7	3.0	19.3	372.5
B TOP	T	442	8.8	18.6	12.6	2.5	6.3
	U	442	-41.9	40.3	1.2	14.1	198.8
	V	442	42.6	128.4	24.5	28.4	806.6
B BOT	T	442	6.5	13.0	8.9	1.4	2.0
	U	442	-23.9	26.1	2.2	8.8	77.4
	V	442	-52.8	44.0	3.9	16.2	262.4
C TOP	T	441	9.7	17.5	12.9	2.0	4.2
	U	441	-26.3	28.8	4.0	9.5	89.3
	V	441	-41.1	114.7	31.9	32.9	1083.7
C MID	T	390	8.8	15.5	11.2	1.6	2.6
	U	412	-41.2	64.3	0.9	13.2	174.2
	V	412	-44.4	95.4	22.6	26.1	681.2
C BOT	T	442	7.4	12.5	9.4	1.0	1.0
	U	442	-15.1	14.2	0.6	4.6	21.2
	V	442	-40.0	53.0	9.3	19.1	364.8
D TOP	T	439	9.8	18.0	13.3	1.9	3.6
	U	244	-21.1	31.1	4.0	8.3	68.9
	V	244	-26.7	95.0	31.4	28.7	823.7
D MID	T	442	8.6	15.9	11.4	1.6	2.6
	U	442	-24.3	26.1	1.4	6.4	41.0
	V	442	-43.1	102.1	24.3	28.4	806.6
D BOT	T	442	7.6	12.3	9.4	1.0	1.0
	U	442	-12.3	12.6	0.2	3.8	14.4
	V	442	-32.2	49.1	8.1	16.2	262.4

Table 4. Sub-band variance ratios for temperature (T) and velocity components (u, v) from each instrument. The sub-bands approximately divide the principal tidal and inertial spectrum (3-40 HRBP) for the low frequency spectrum (40 HRLP).

Current meter	Parameter	Variance ratio 3-40 HR BP / 3 HRLP	Variance ratio 40 HRLP / 3 HRLP
A TOP	T	0.09	0.91
	U	0.56	0.44
	V	0.06	0.91
A BOT	T	0.11	0.83
	U	0.66	0.30
	V	0.10	0.84
B TOP	T	0.03	1.00
	U	0.18	0.81
	V	0.06	0.94
B BOT	T	0.04	0.87
	U	0.33	0.64
	V	0.09	0.88
C TOP	T	0.05	0.95
	U	0.31	0.67
	V	0.05	0.96
C MID	T	0.09	0.81
	U	0.18	0.67
	V	0.07	0.96
C BOT	T	0.25	0.83
	U	0.76	0.23
	V	0.10	0.93
D TOP	T	0.10	0.90
	U	0.37	0.66
	V	0.06	0.98
D MID	T	0.10	0.90
	U	0.43	0.53
	V	0.05	0.97
D BOT	T	0.17	0.83
	U	0.78	0.24
	V	0.10	0.93

The 3 HRLP mean velocity vectors are shown on the mooring array plan view. (Fig. 3). The largest mean departure from the downstream direction occurred for the A–bottom instrument, possibly reflecting the importance of bottom topography as the meandering Stream moved in and out of shoaling waters.

Polar histograms giving the distribution of the normalized, cumulative 3 HRLP vector magnitude are shown in Figs. 10 through 19. All of the bottom instruments and A–top had significant times of countercurrents. The fluctuations were more or less rectilinear, except at A–bot, where the distribution has an asymmetric property. It is apparent from Figs. 10 through 19 (and *not* from Fig. 3) that the onshore mean component primarily results from the correlation of onshore flow with only the downstream flow component. The coordinate rotation angle is shown in Figs. 10 through 19 by the radial tick mark at 34° clockwise from north.

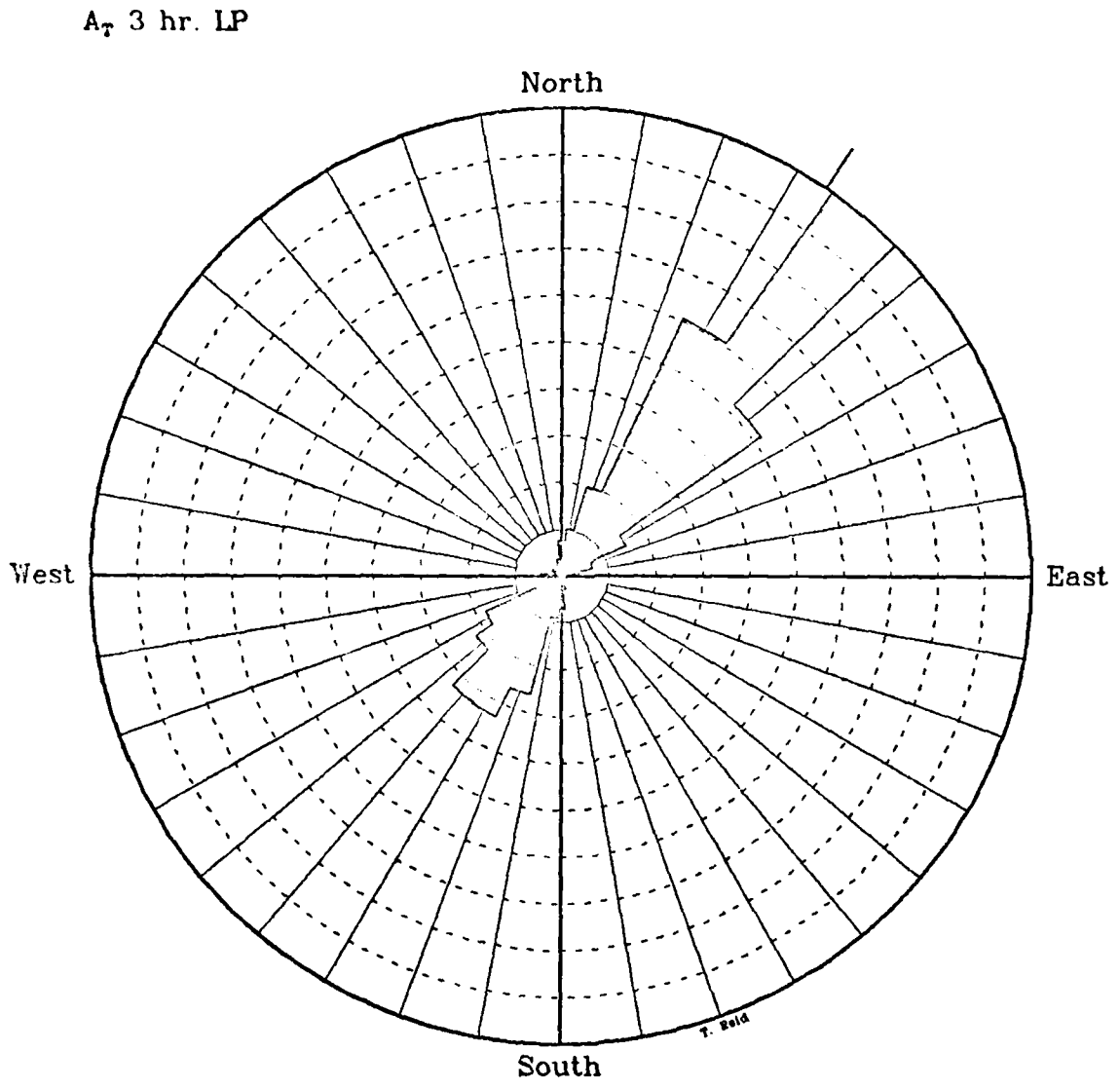


Figure 10. Polar histogram for instrument A–top showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

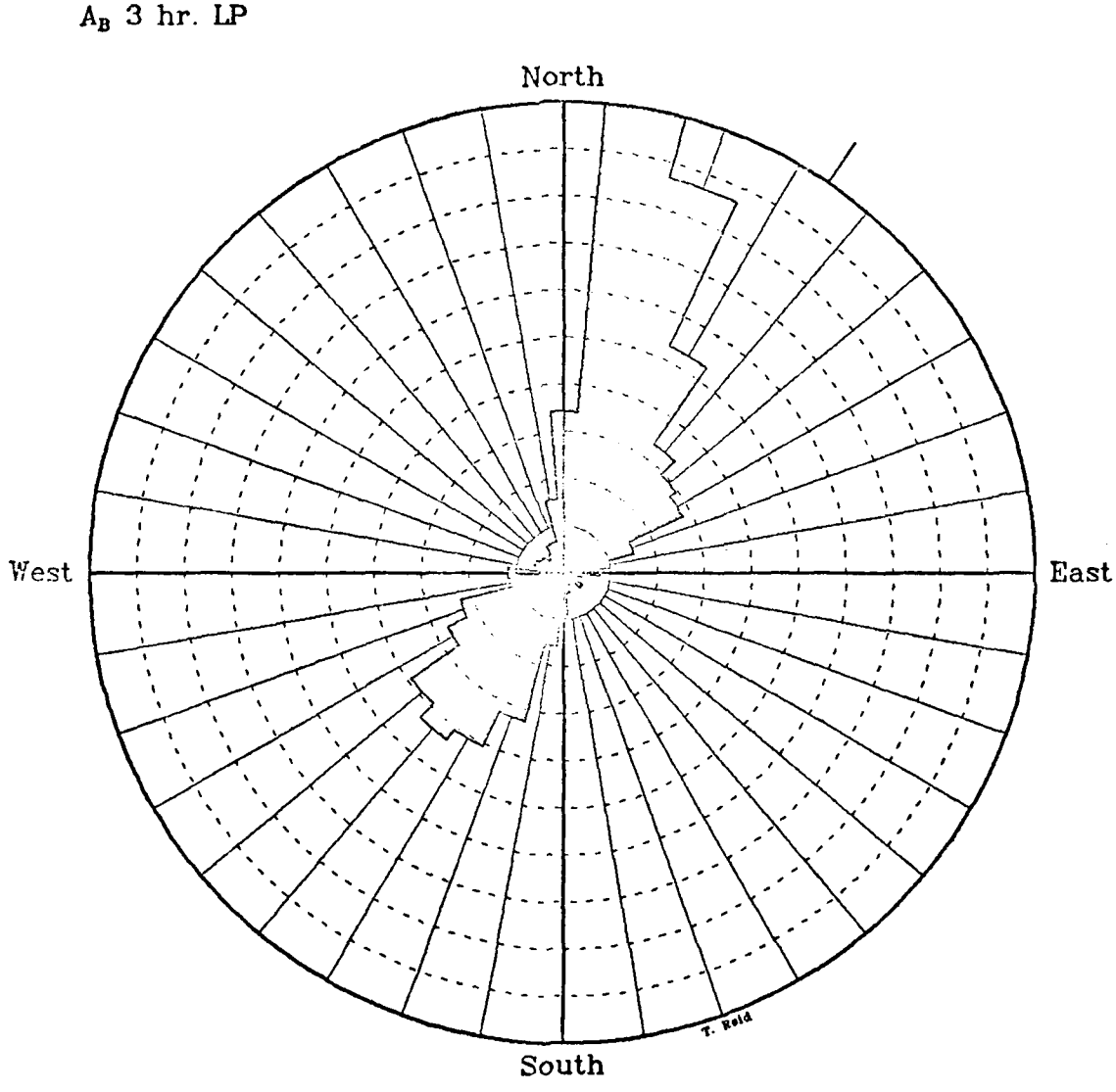


Figure 11. Polar histogram for instrument A-bot showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

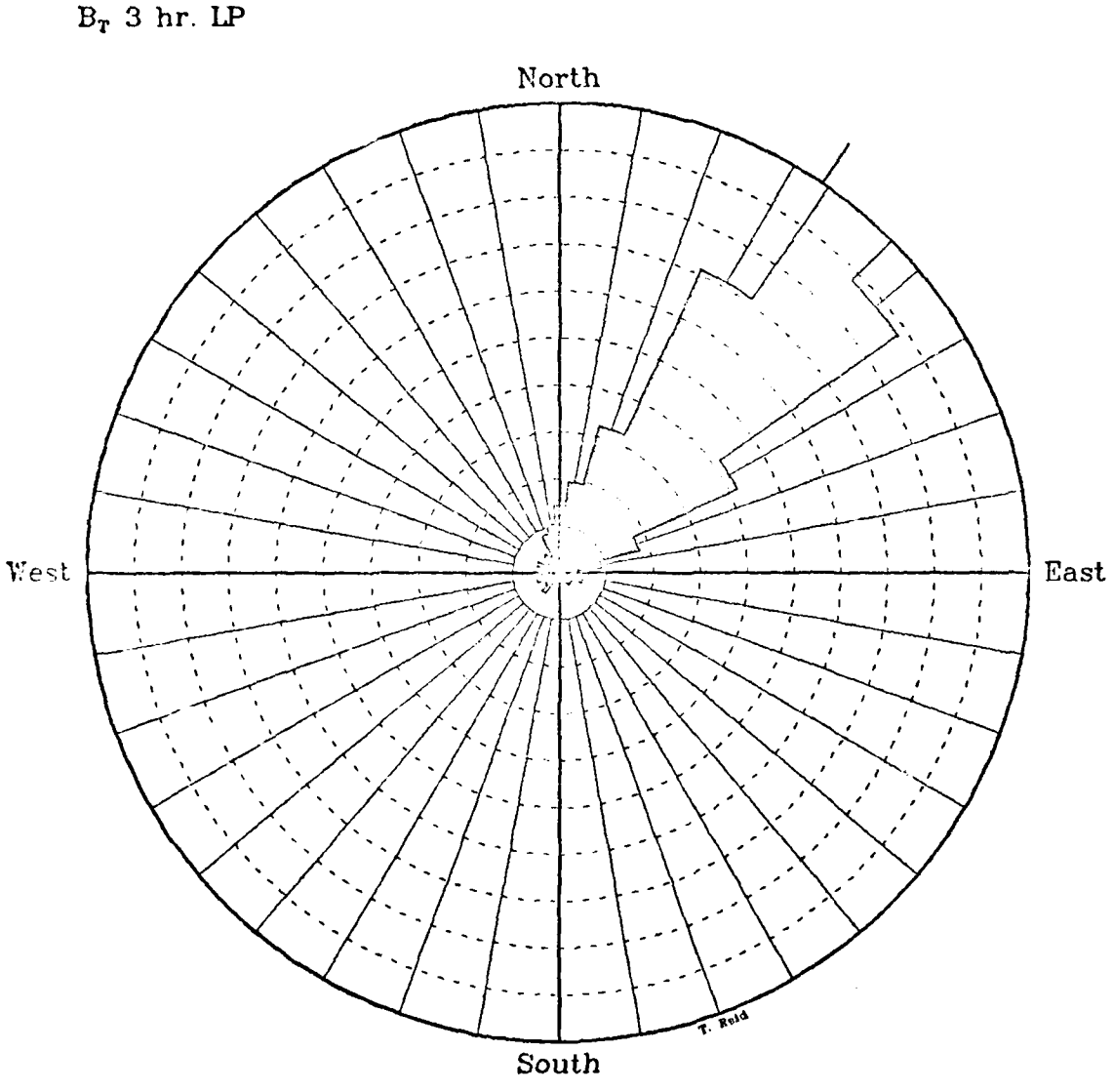


Figure 12. Polar histogram for instrument B-top showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

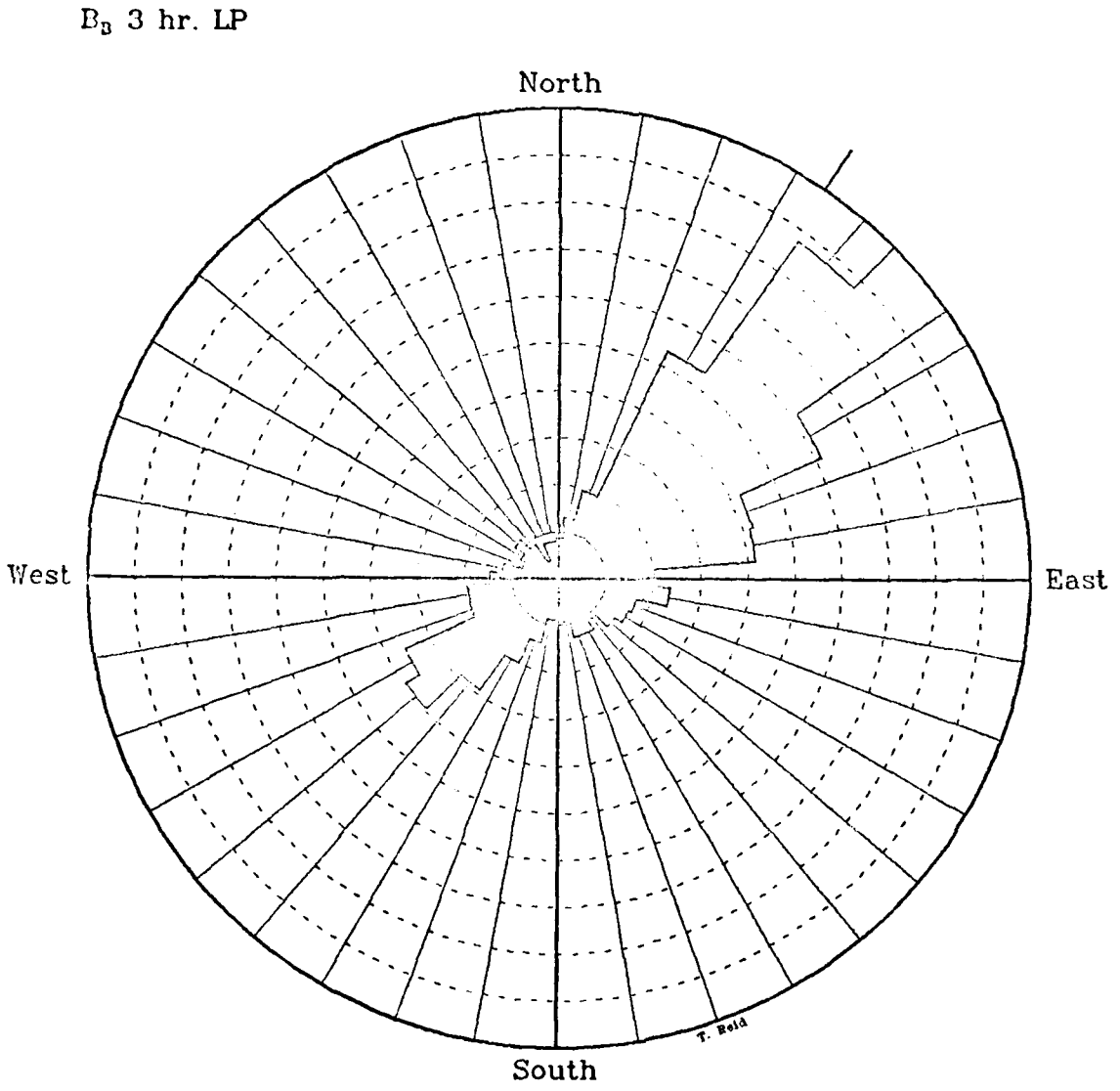


Figure 13. Polar histogram for instrument B-bot showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

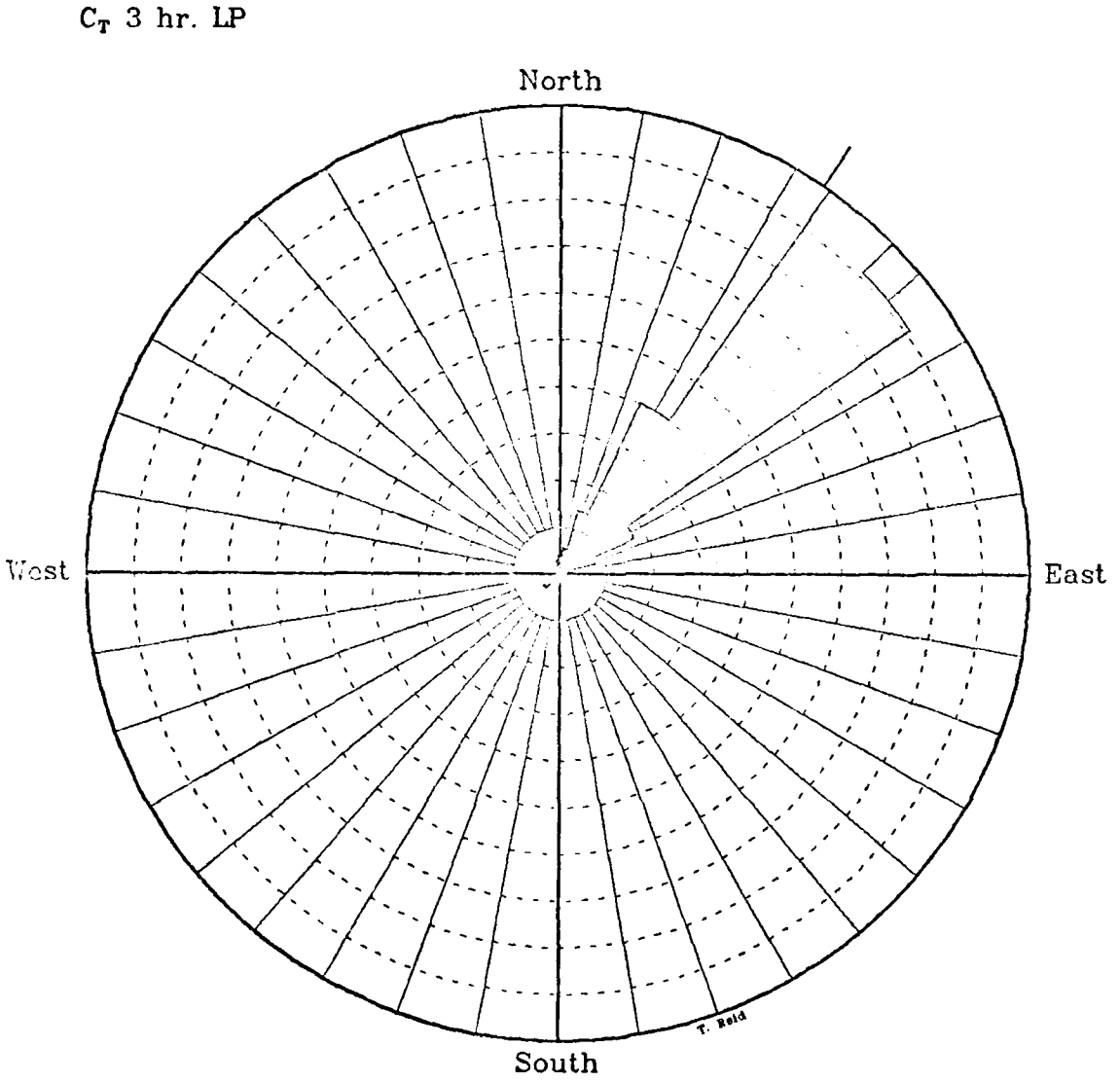


Figure 14. Polar histogram for instrument C–top showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

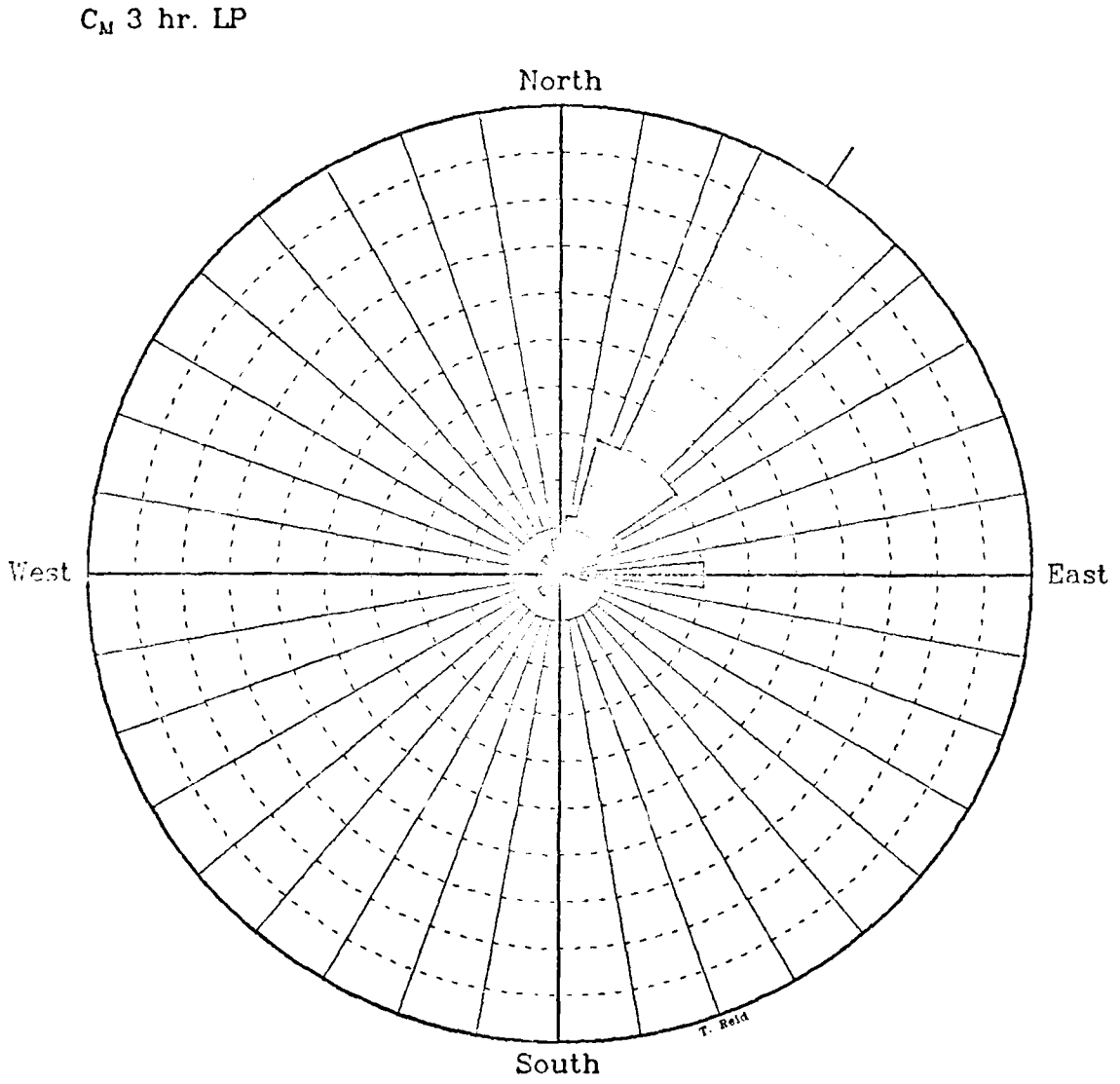


Figure 15. Polar histogram for instrument C–mid showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

C_B 3 hr. LP

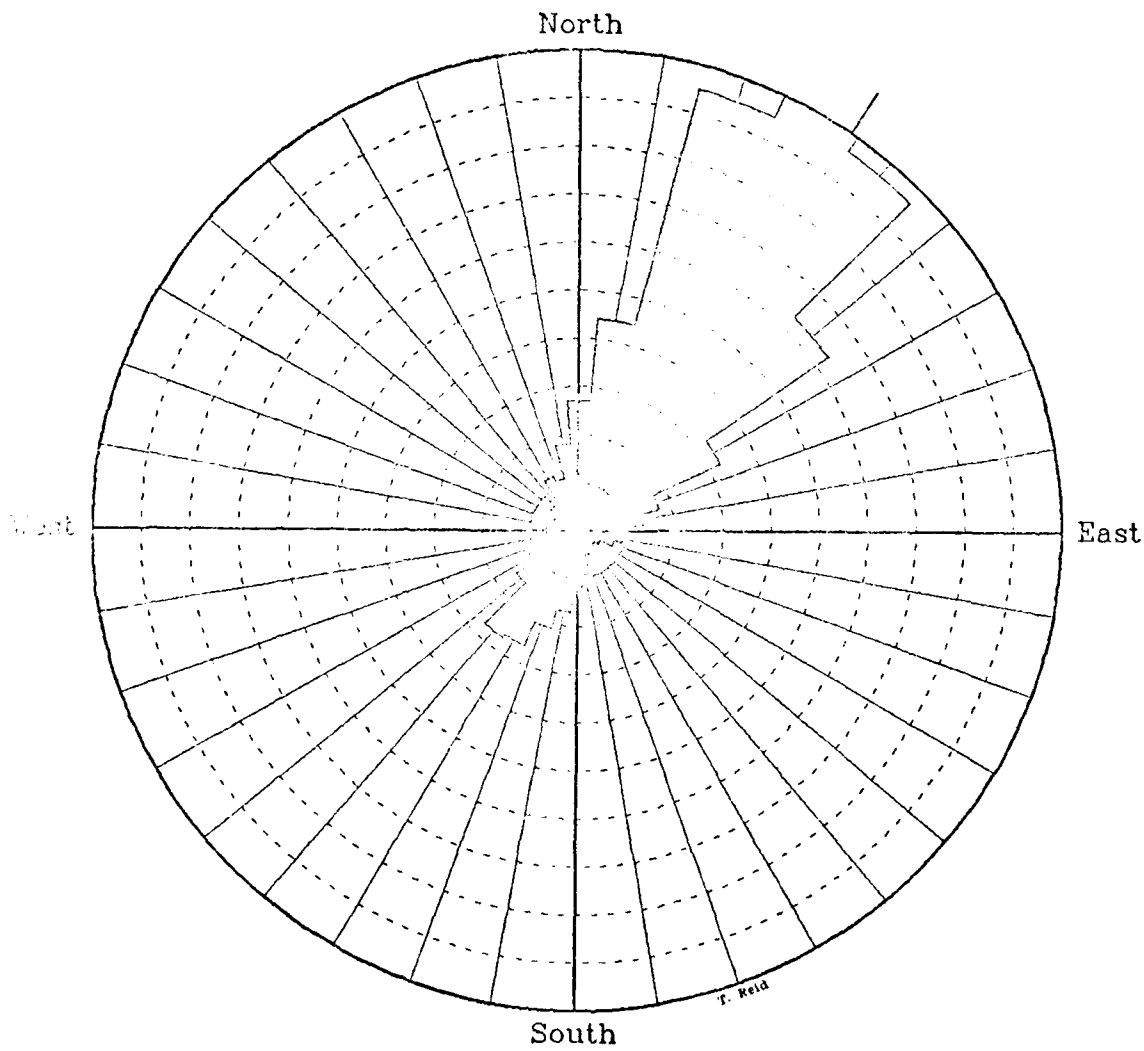


Figure 16. Polar histogram for instrument C-bot showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

D_T 3 hr. LP

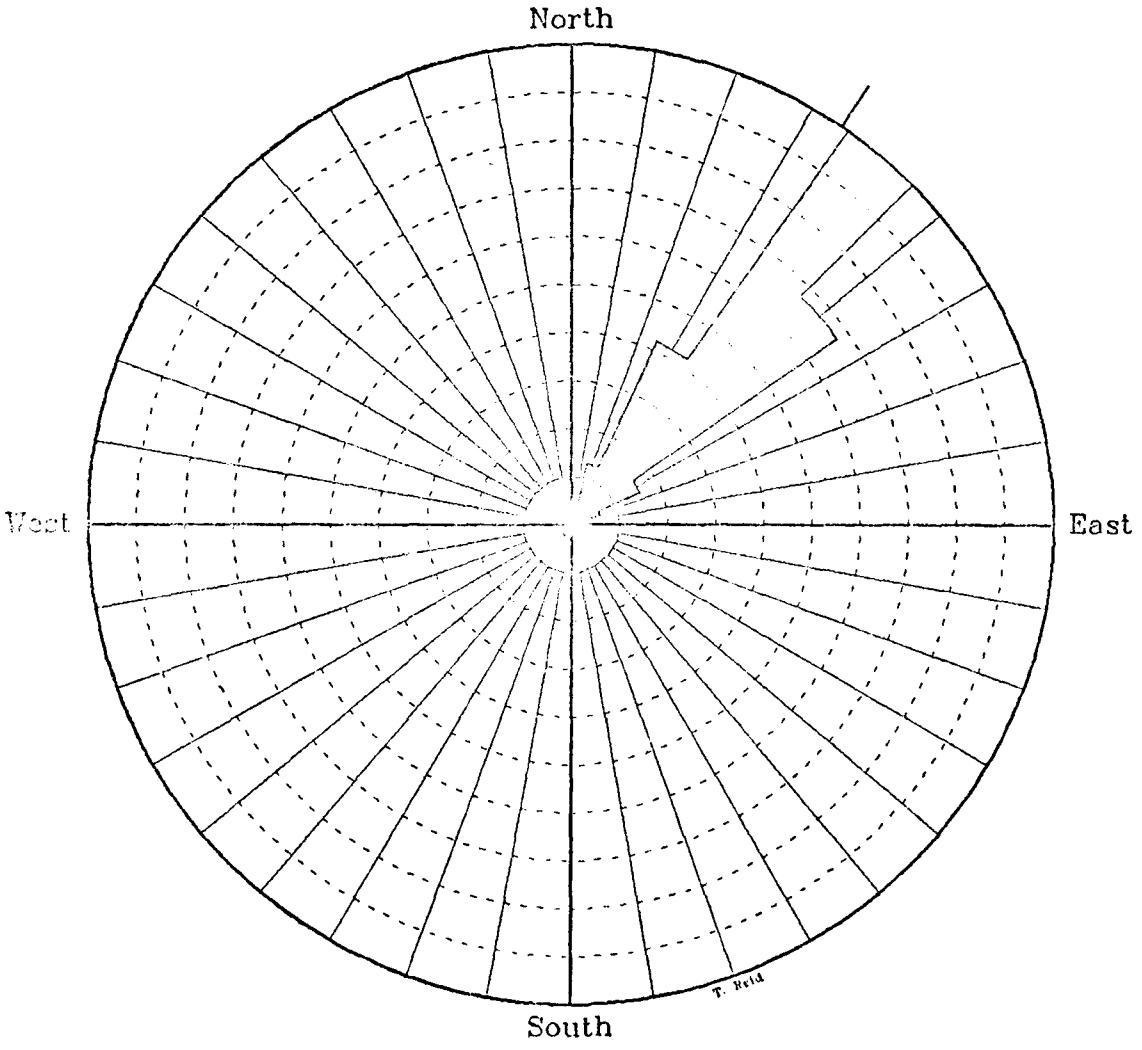


Figure 17. Polar histogram for instrument D-top showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

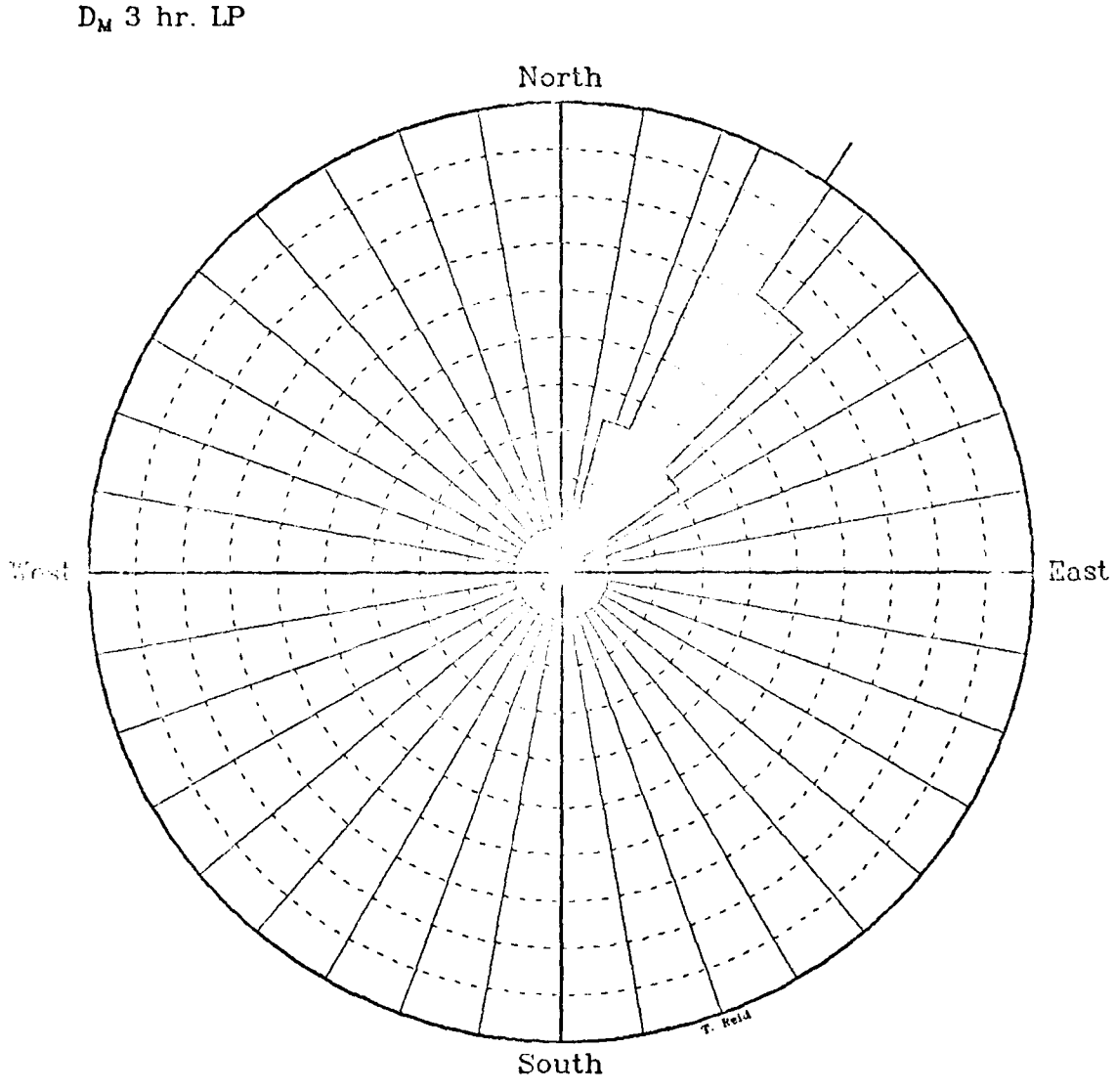


Figure 18. Polar histogram for instrument D-mid showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

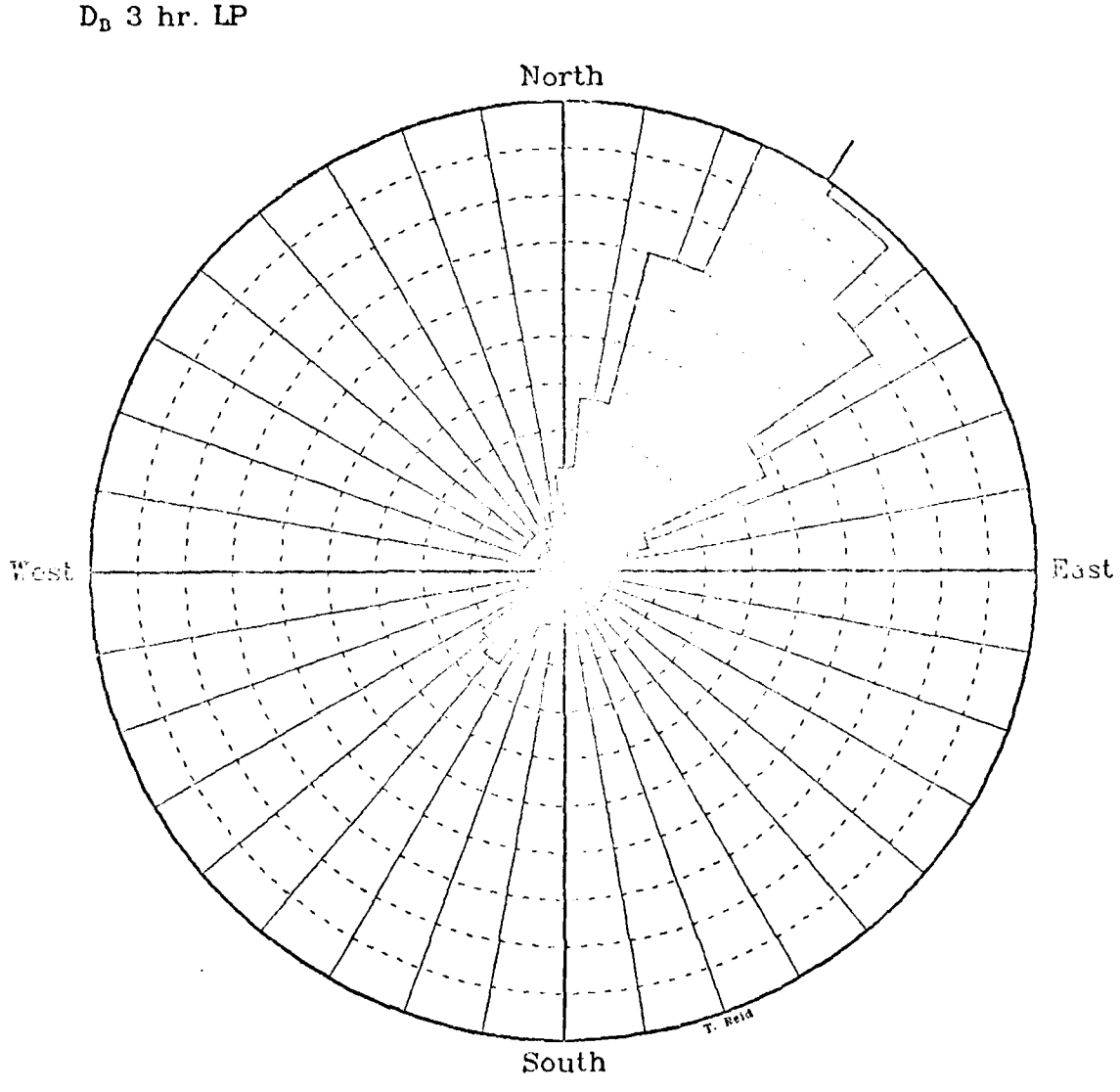


Figure 19. Polar histogram for instrument D-bot showing the normalized magnitude distribution of the 3 HRLP velocity, accumulated vectorially in ten degree sectors. The downstream (+ v) direction of the rotated coordinate system is shown by the radial tick mark.

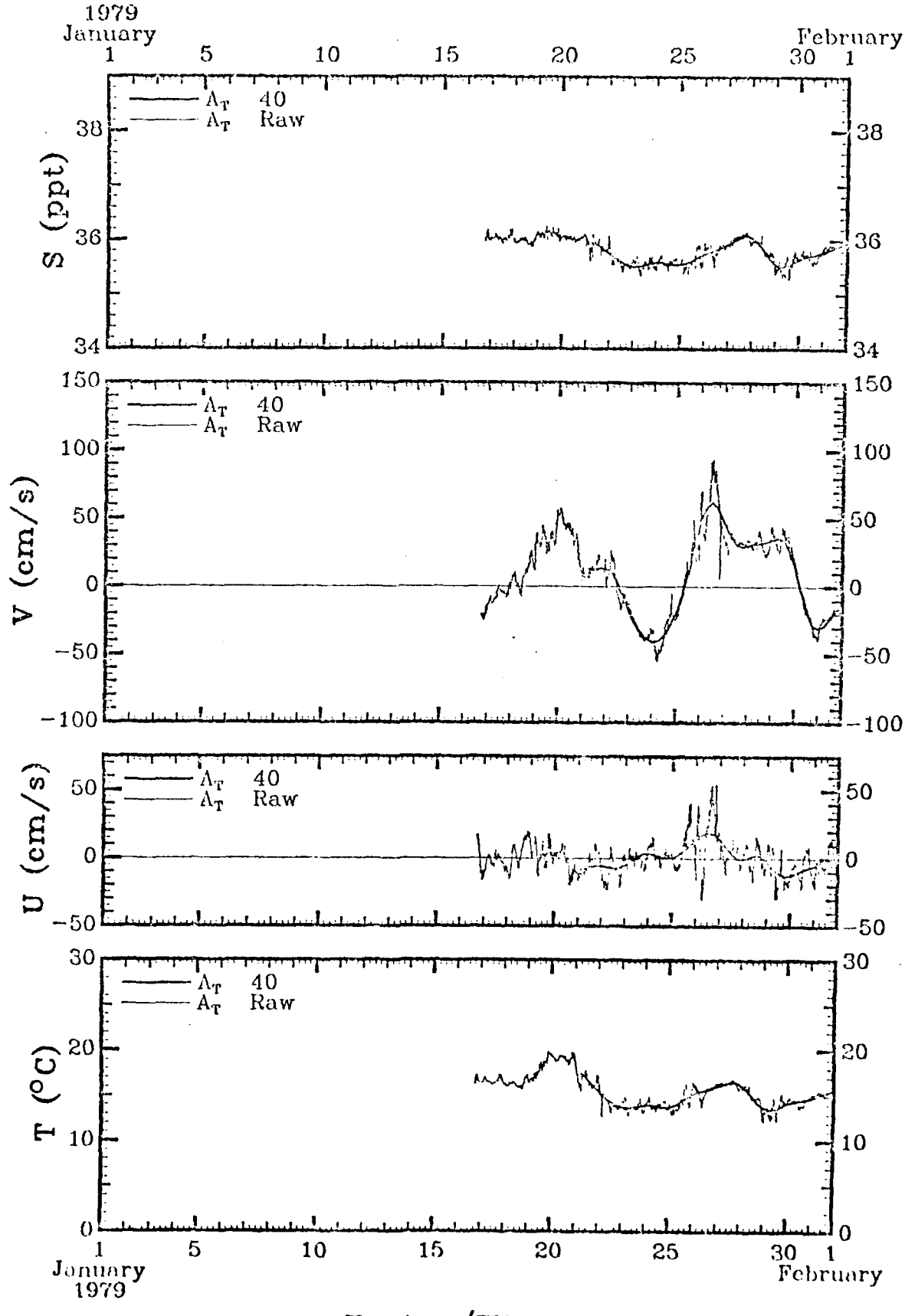
2.7 DATA PRESENTATION FORMATS

The current meter, sea level height, and atmospheric data sets are presented in the remainder of the report. Sections 3 through 5 show the current meter data in time series format and Section 6 shows the currents in "stick" plot format. Sections 7 through 9 show various combinations of the three data sets in time series format. All times in this report are given in Greenwich Mean Time (GMT). Section 10 shows the current meter data separately and in combination with other data sets in the frequency domain, giving spectrum, cross-spectrum, phase, and coherence information. All spectrum calculations employed the Cooley-Tukey method; that is, Fourier transformation of correlation functions. All frequency domain calculations in this report were carried out with an effective bandwidth of 0.033 cycles per day (CPD), to facilitate intercomparison. Current meter spectrum estimates nominally carry 15 degrees of freedom (DOF), although this number varies somewhat because of early termination of several records. For 15 DOF, the 95% confidence interval on phase estimates is about ±(27, 18, 12) degrees for coherence squared values of (0.4, 0.6, 0.8).

SECTION 3

Raw and 40 HRLP Data for Each Instrument

Figures 20 through 29 show the raw and superimposed 40 HRLP current meter data separately by month for each instrument. Common scaling of similar data has been used throughout this section.


1979
January
February
1 5 10 15 20 25 30 1
A_T 40
A_T Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
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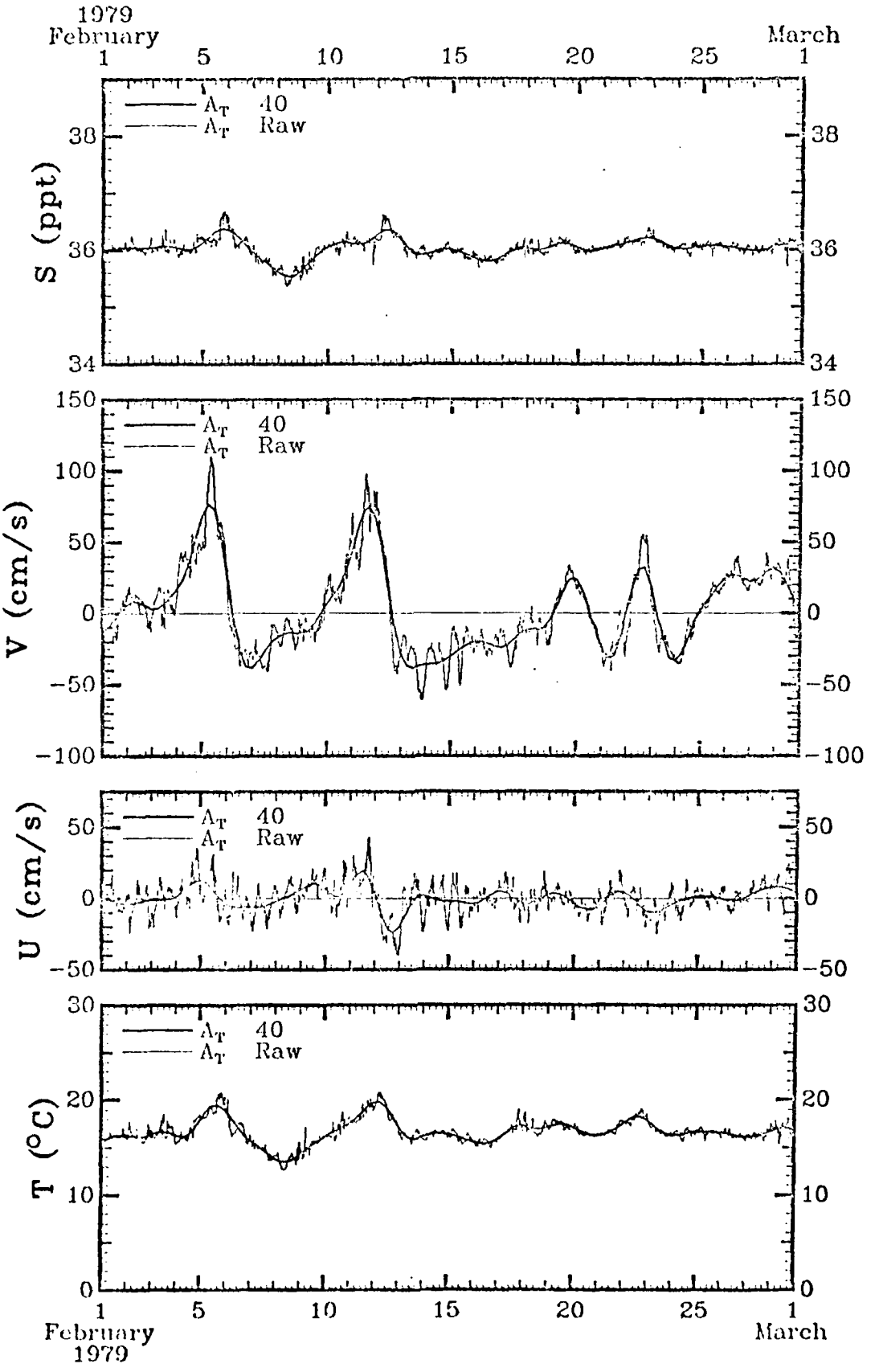
January
1979
February
Date/Time


1979
February
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A_T 40
A_T Raw
S (ppt)
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V (cm/s)
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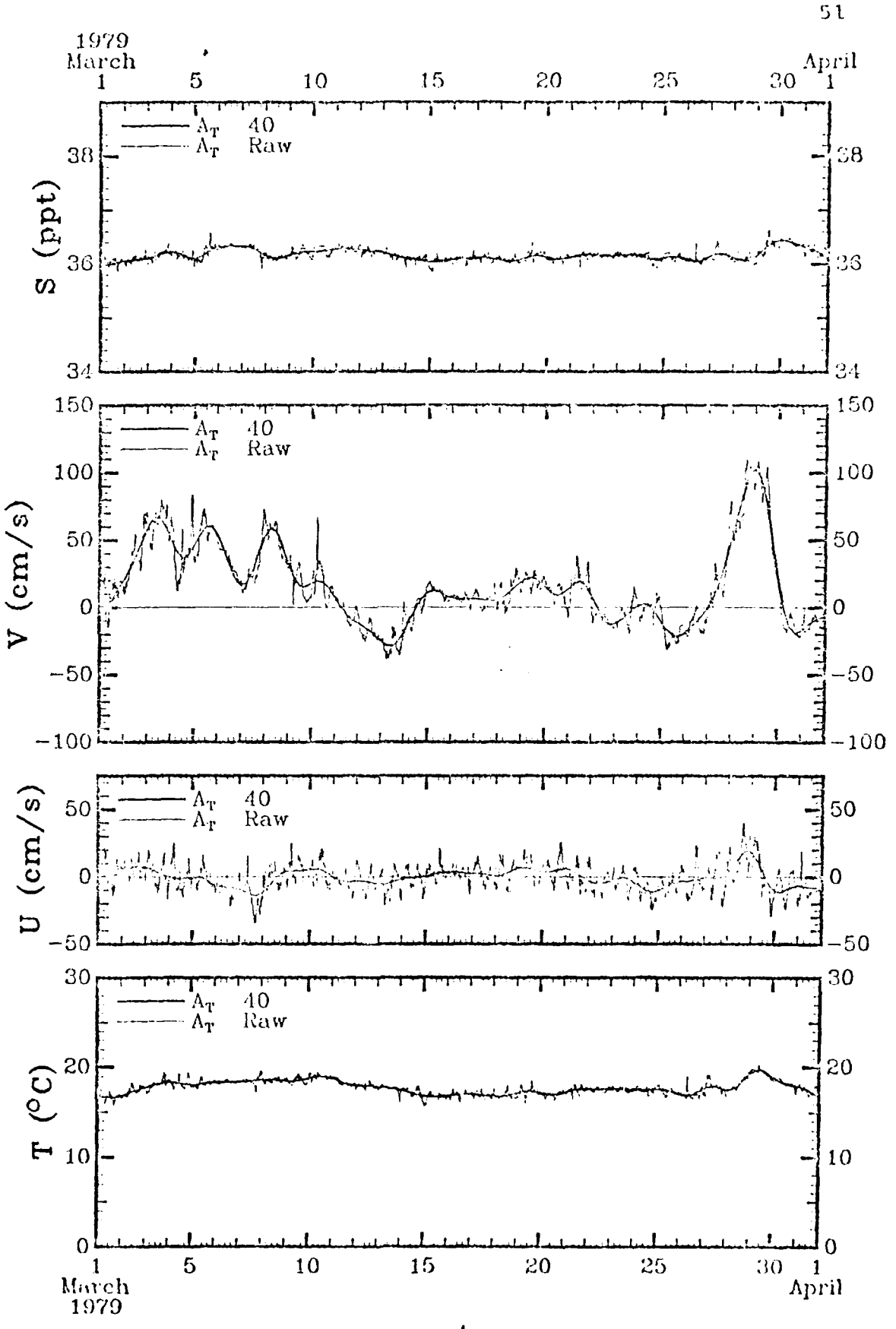
February
1979
March
Date/Time


1979
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A_T 40
A_T Raw
S (ppt)
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V (cm/s)
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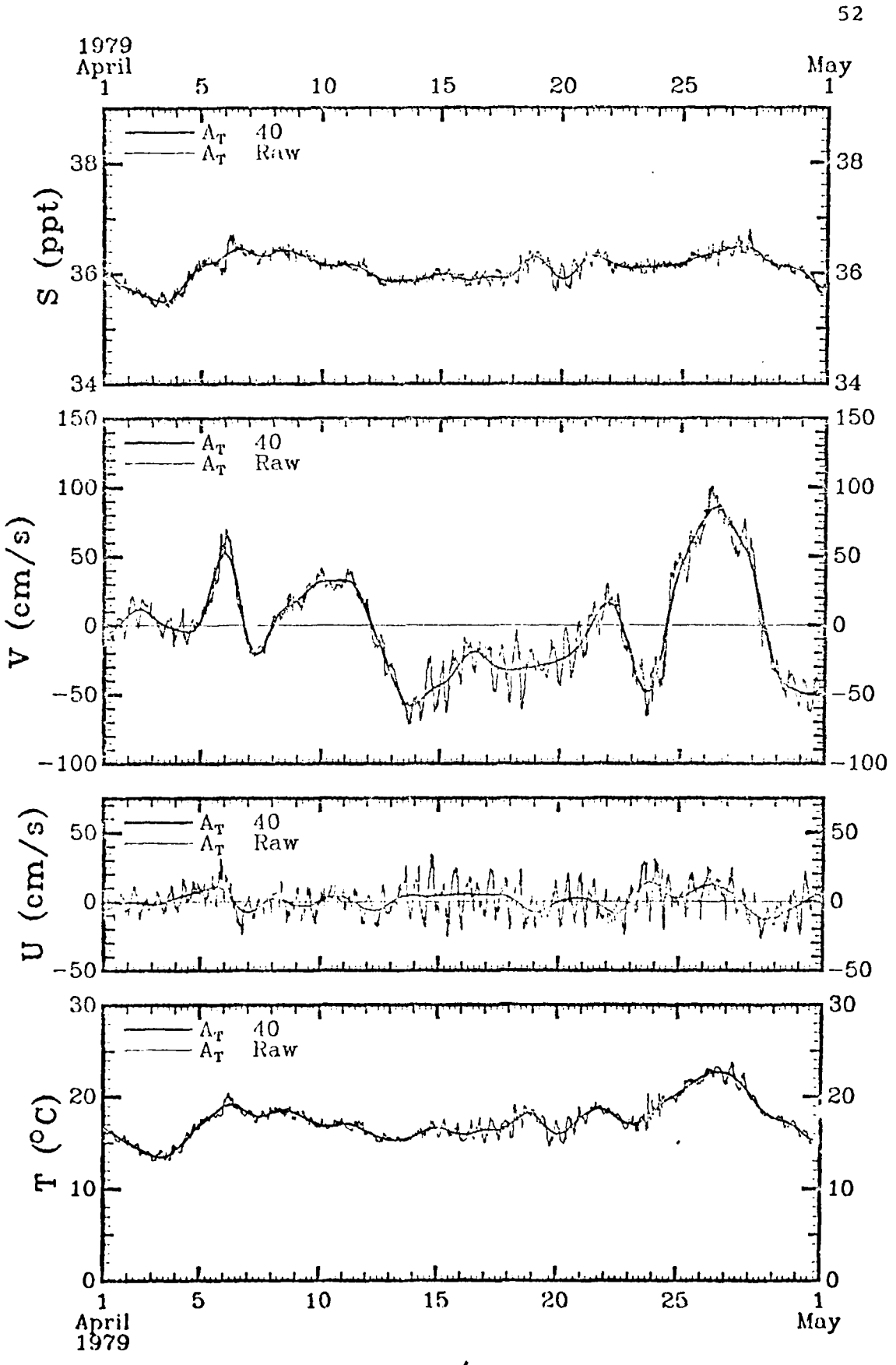
March
1979
April
Date/Time


1979
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A_T 40
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T (°C)
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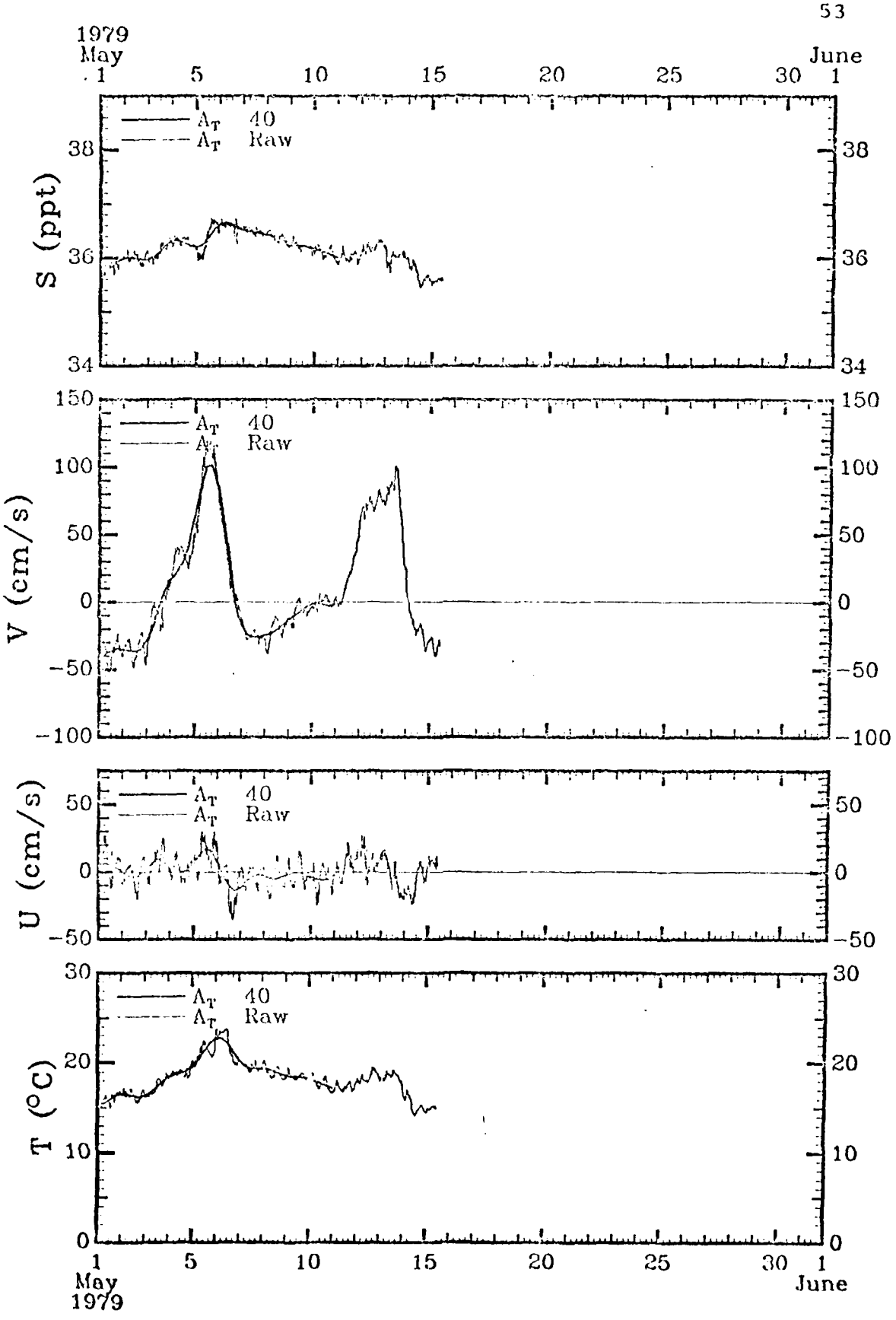
April
1979
May
Date/Time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A_T 40
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V (cm/s)
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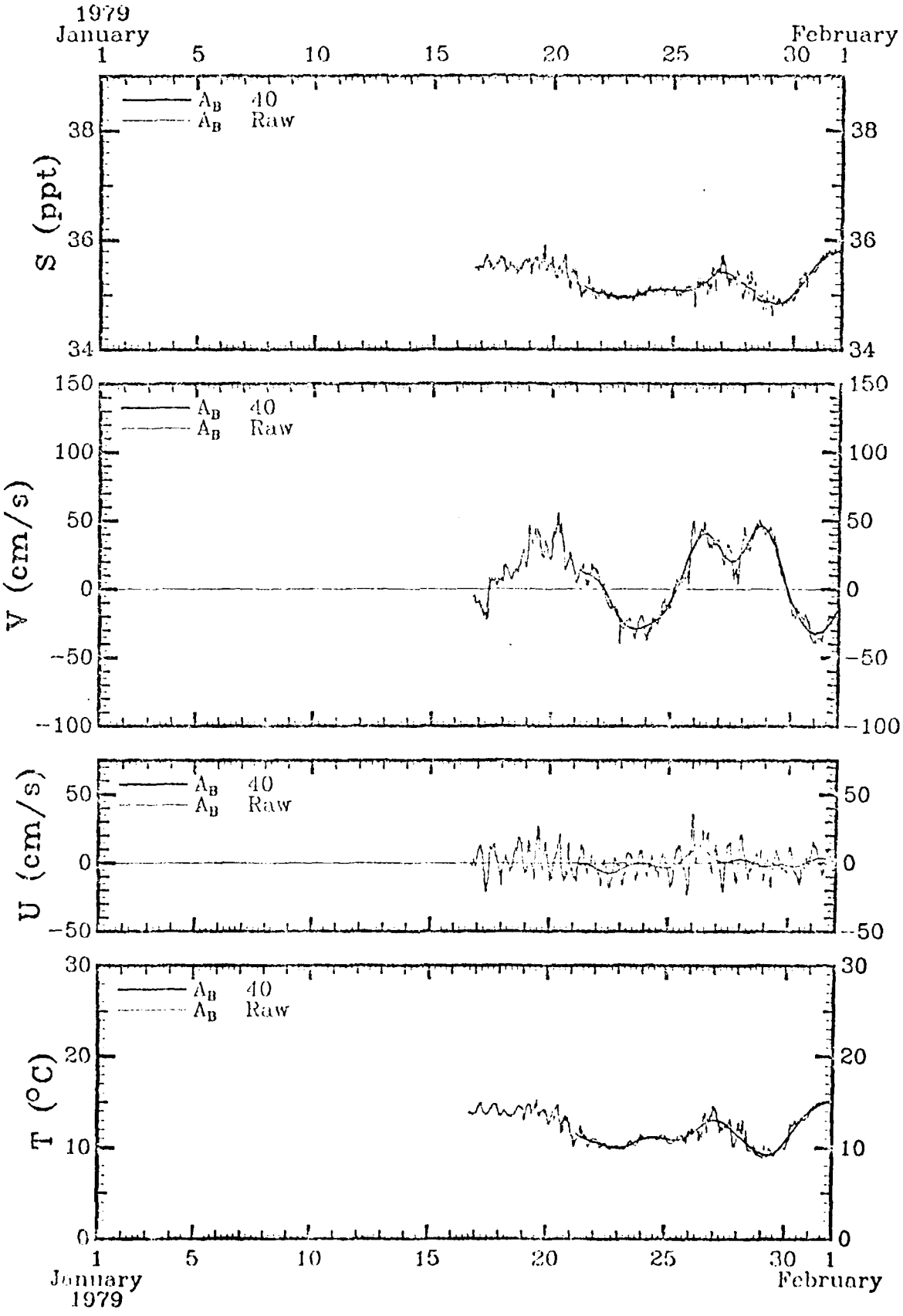
Date/Time


1979
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A_B 40
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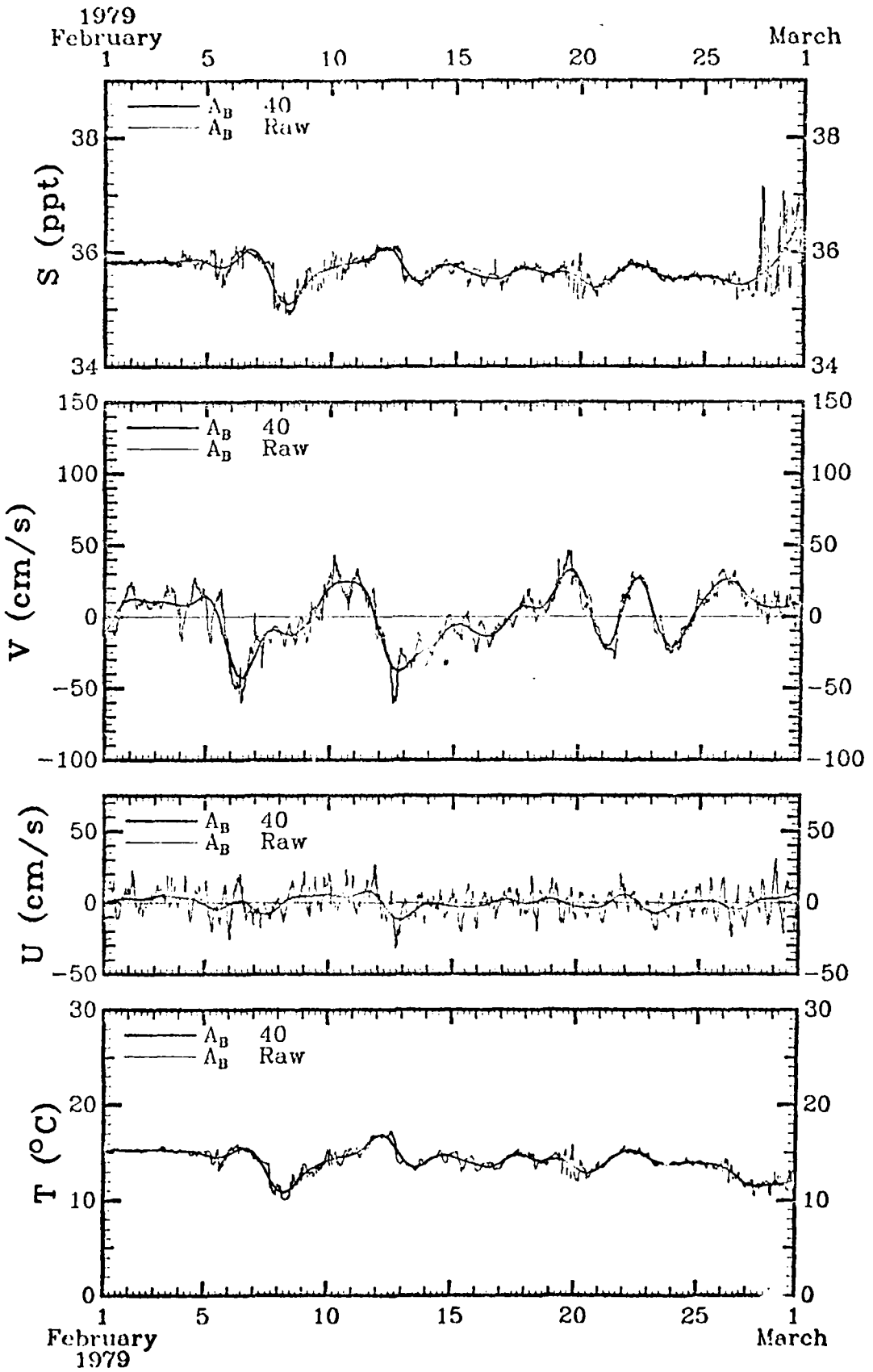
January
1979
Date/Time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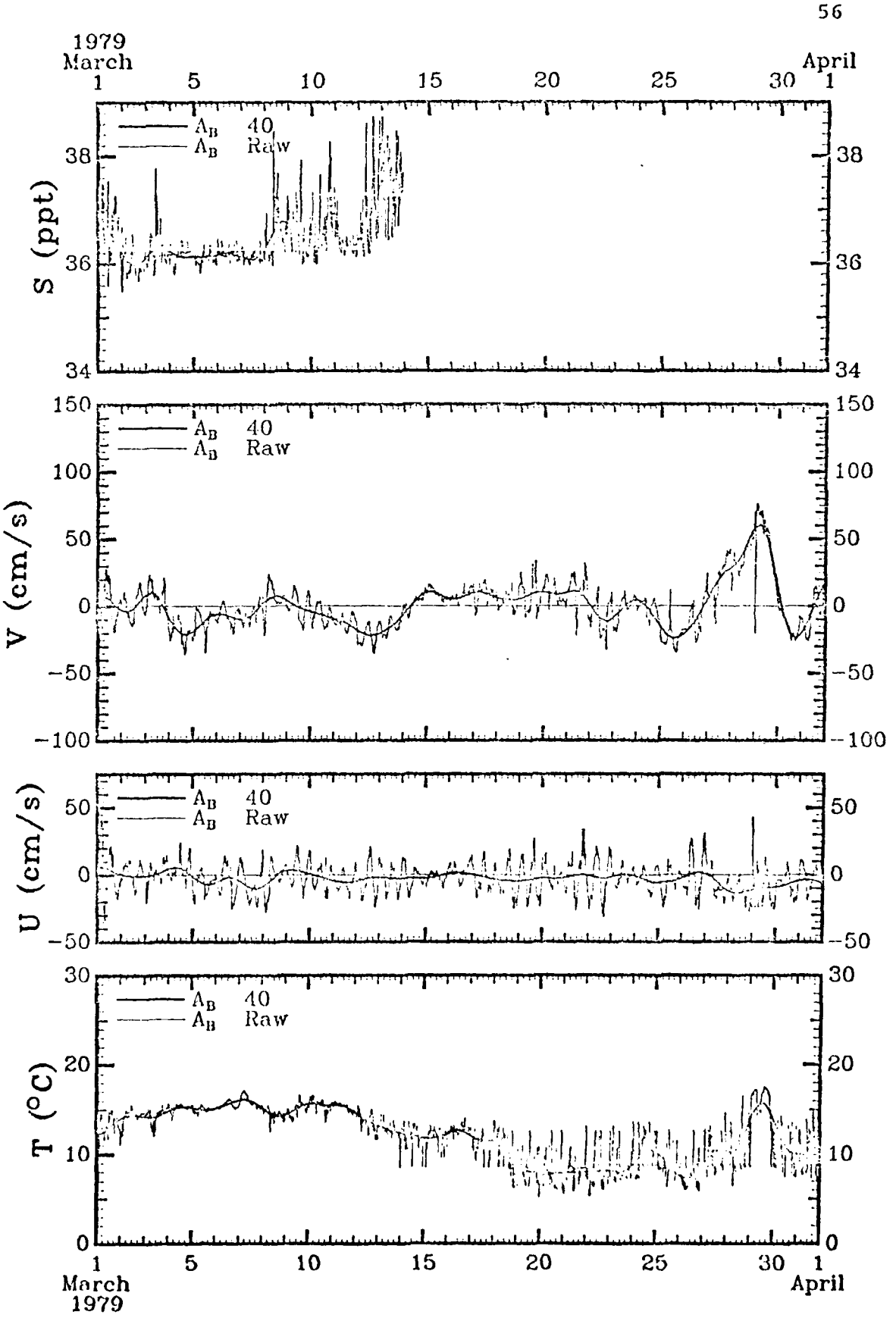
February
1979
March
Date/Time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A_B 40
A_B Raw
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T (°C)
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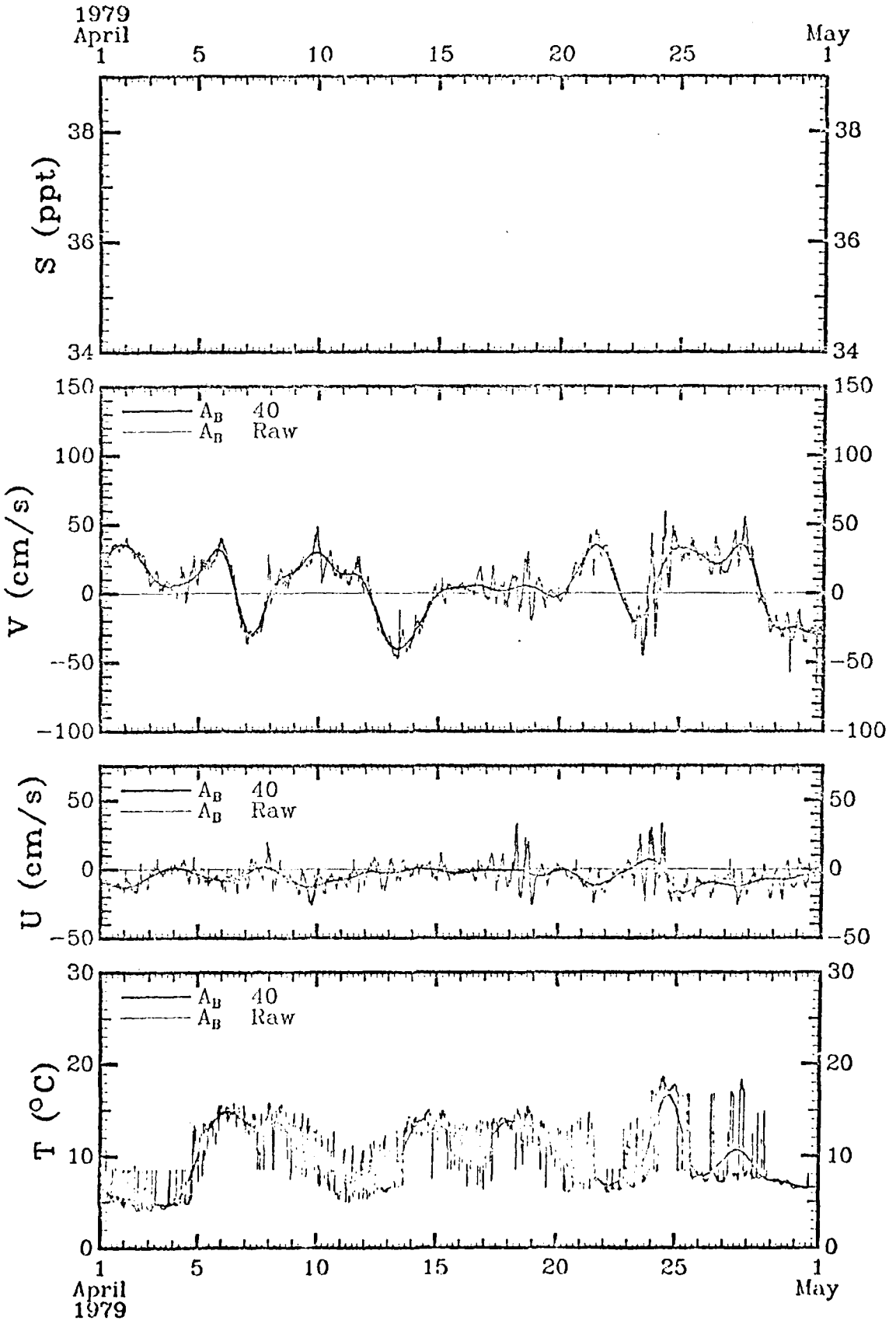
April
Date/Time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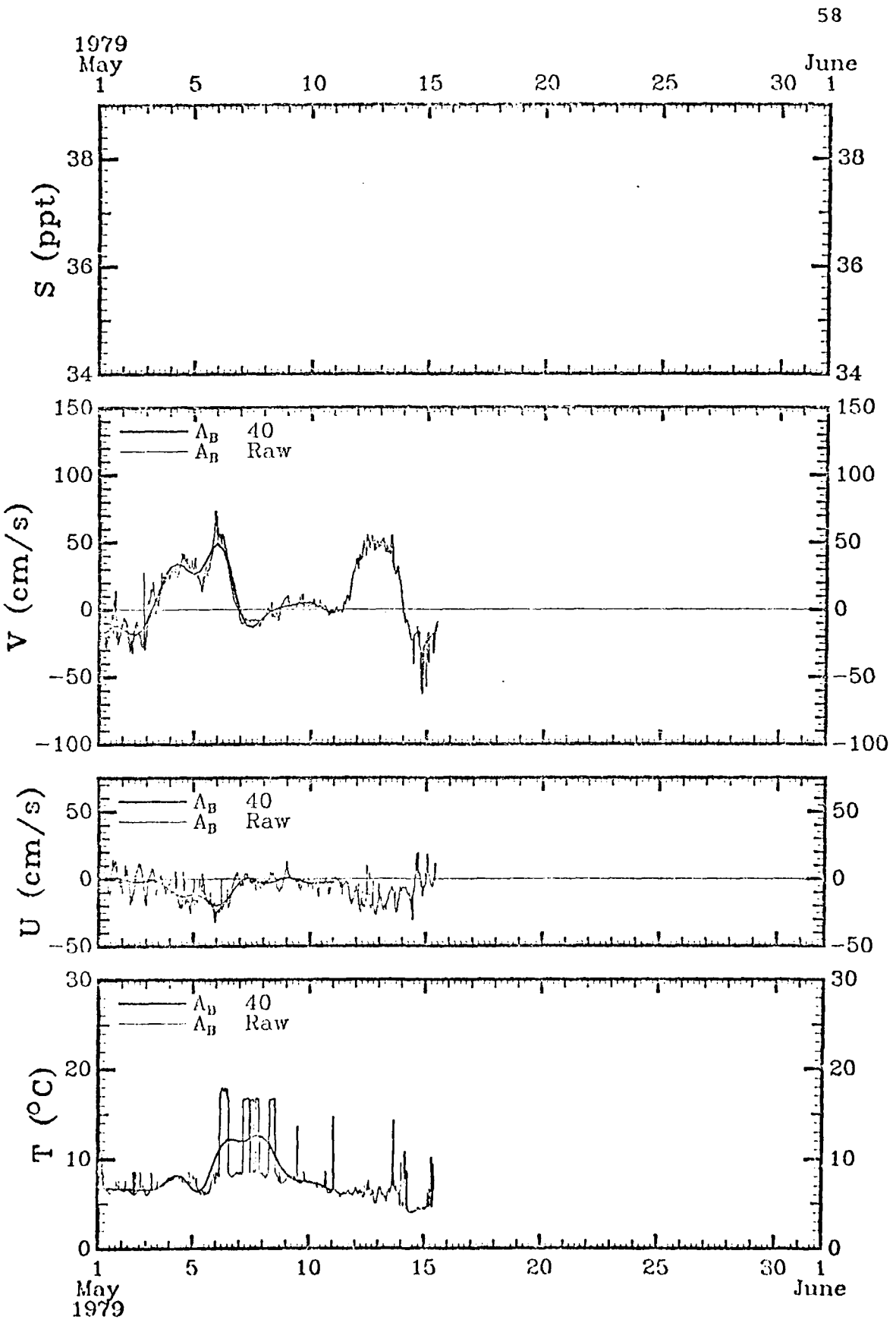
Date/Time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A_B Raw
U (cm/s)
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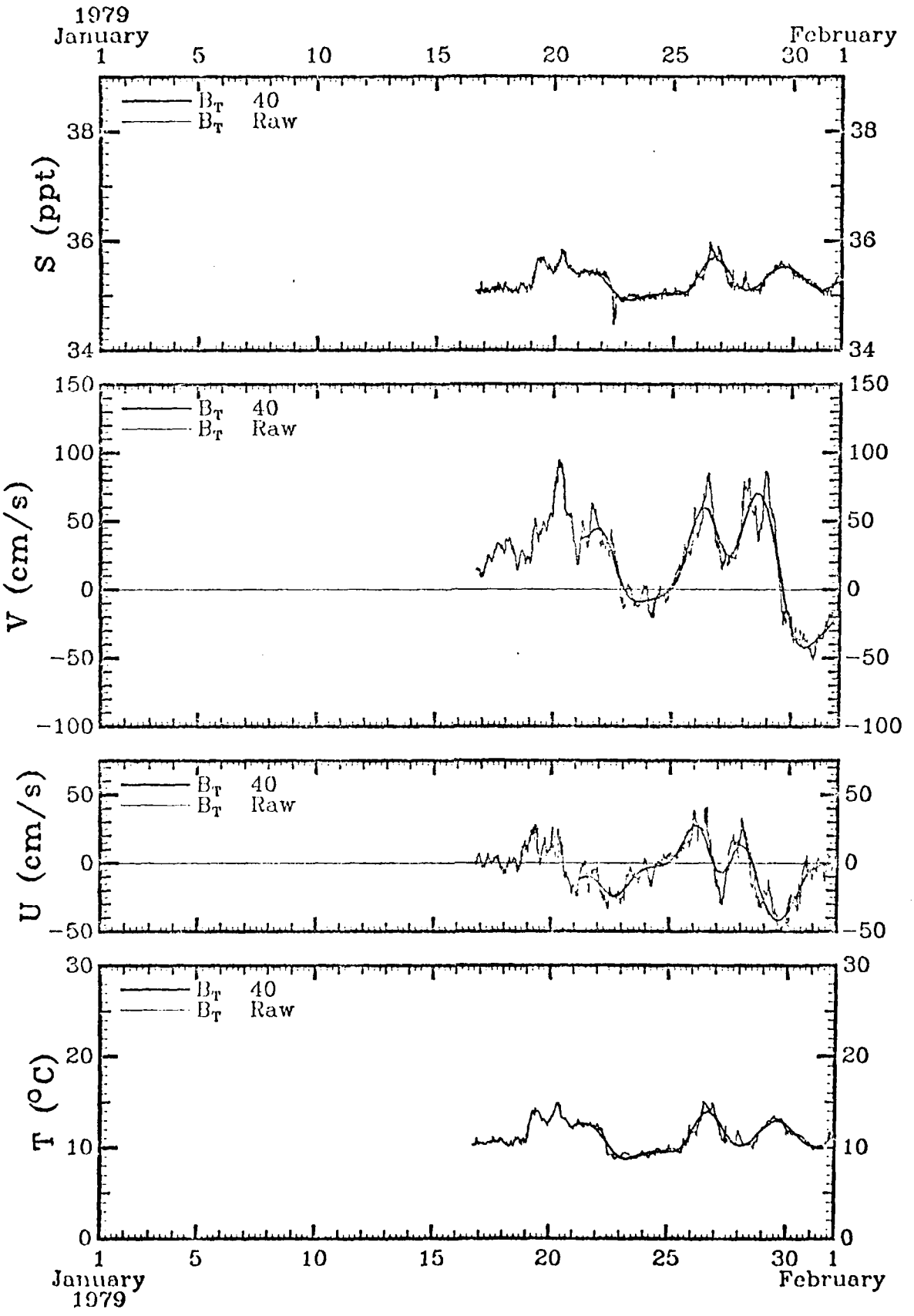
1979
Date/Time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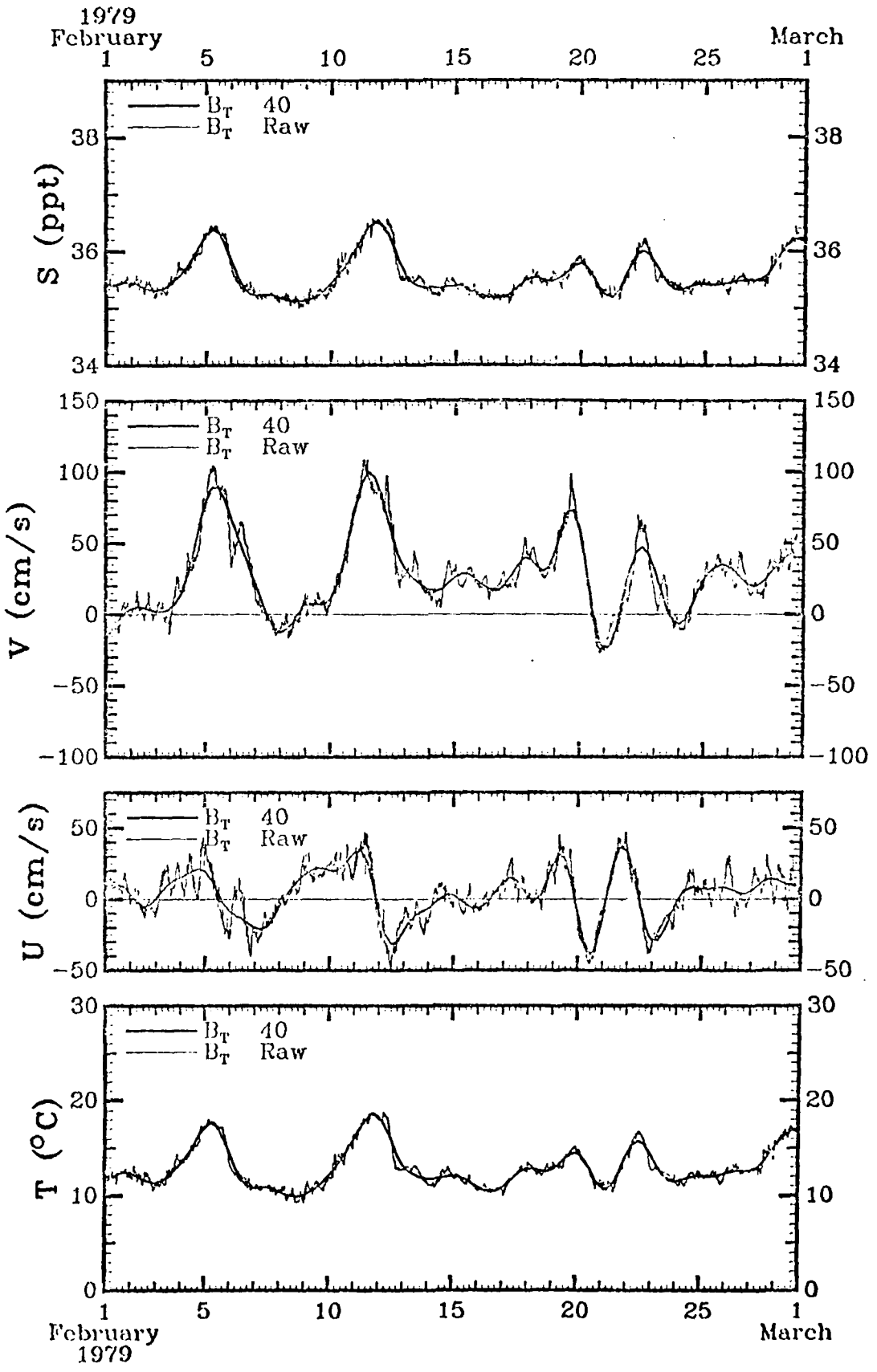
Date/Time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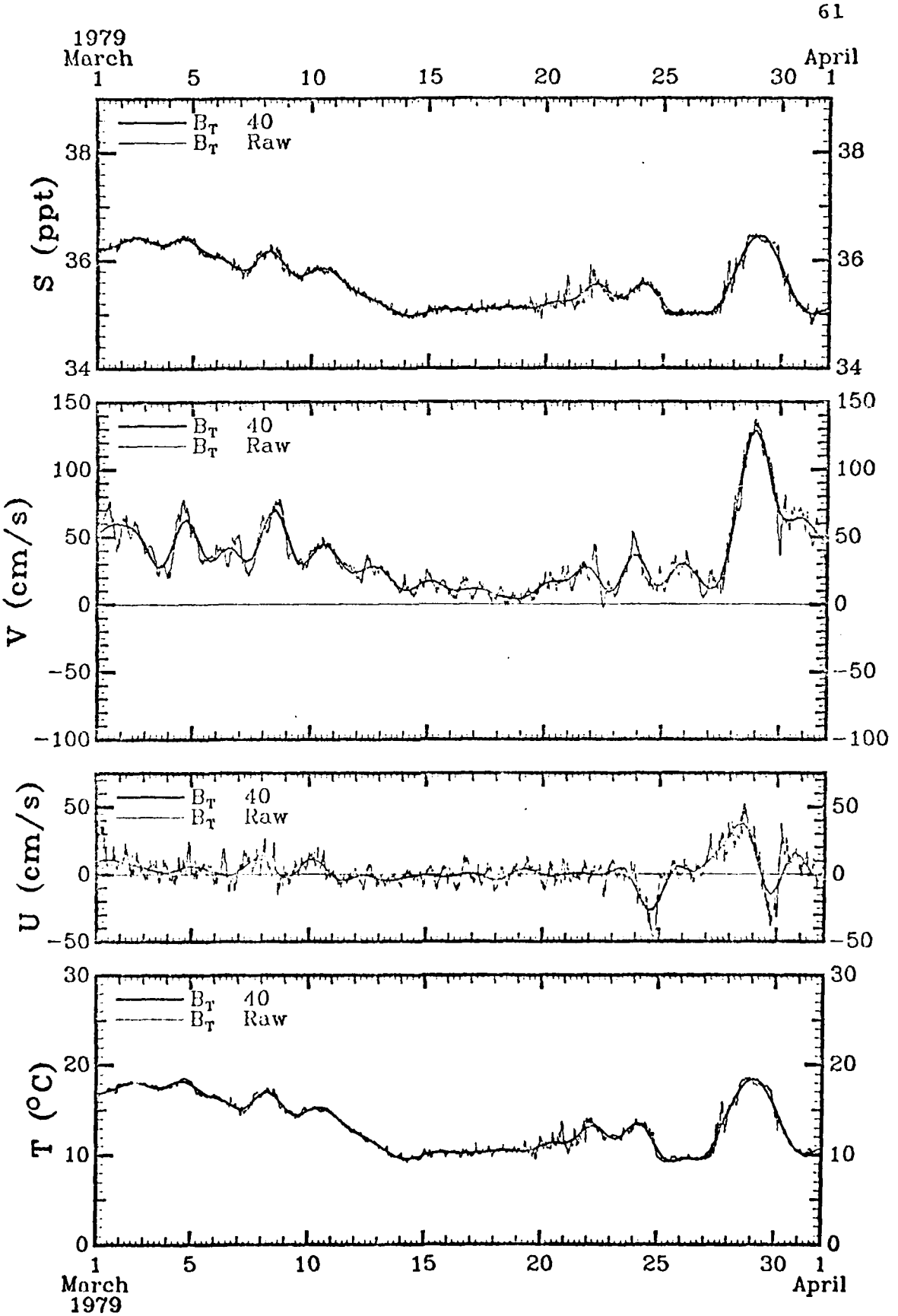
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B_T Raw
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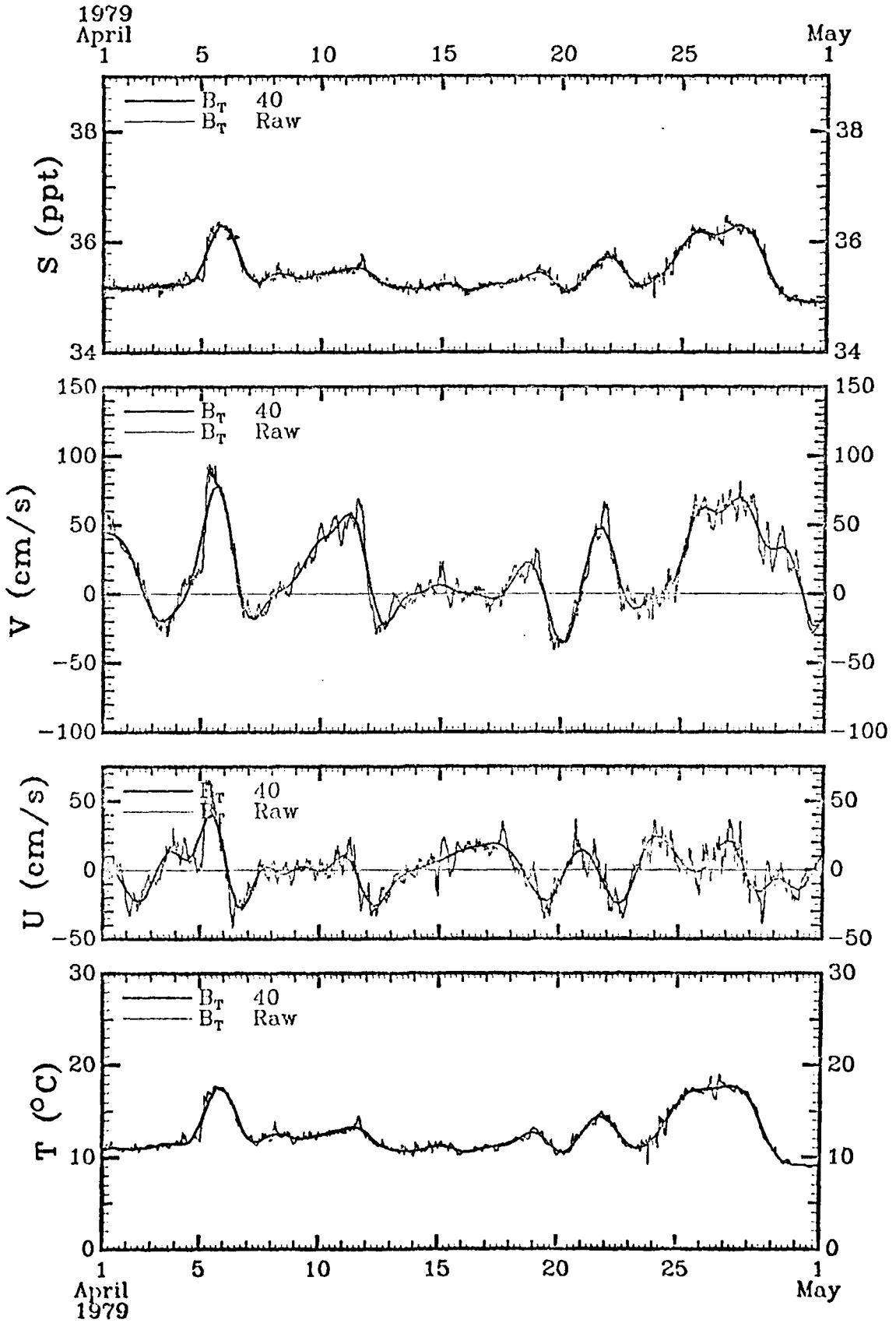
Date/Time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B_T Raw
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U (cm/s)
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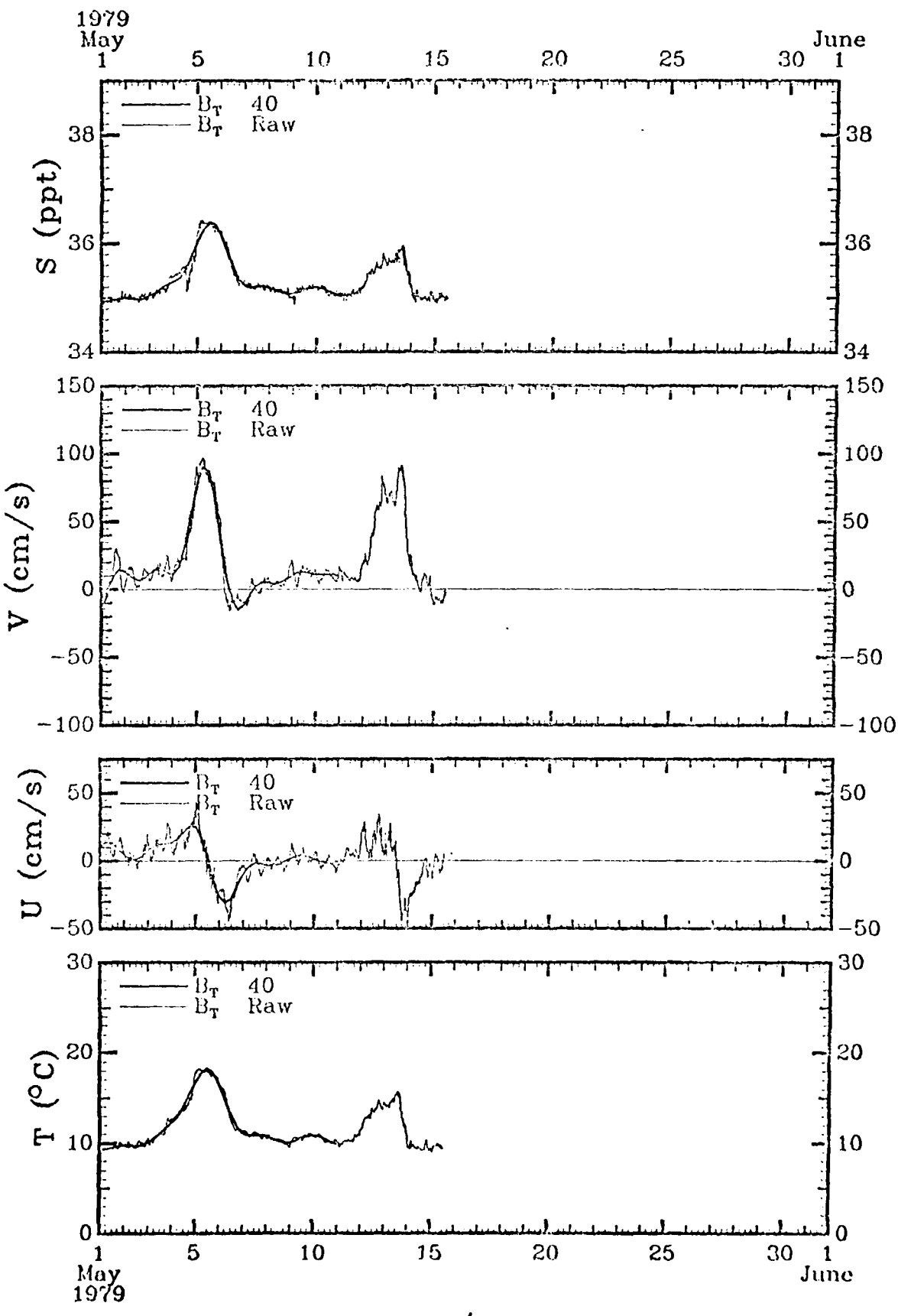
Date/Time


1979
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B_T Raw
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V (cm/s)
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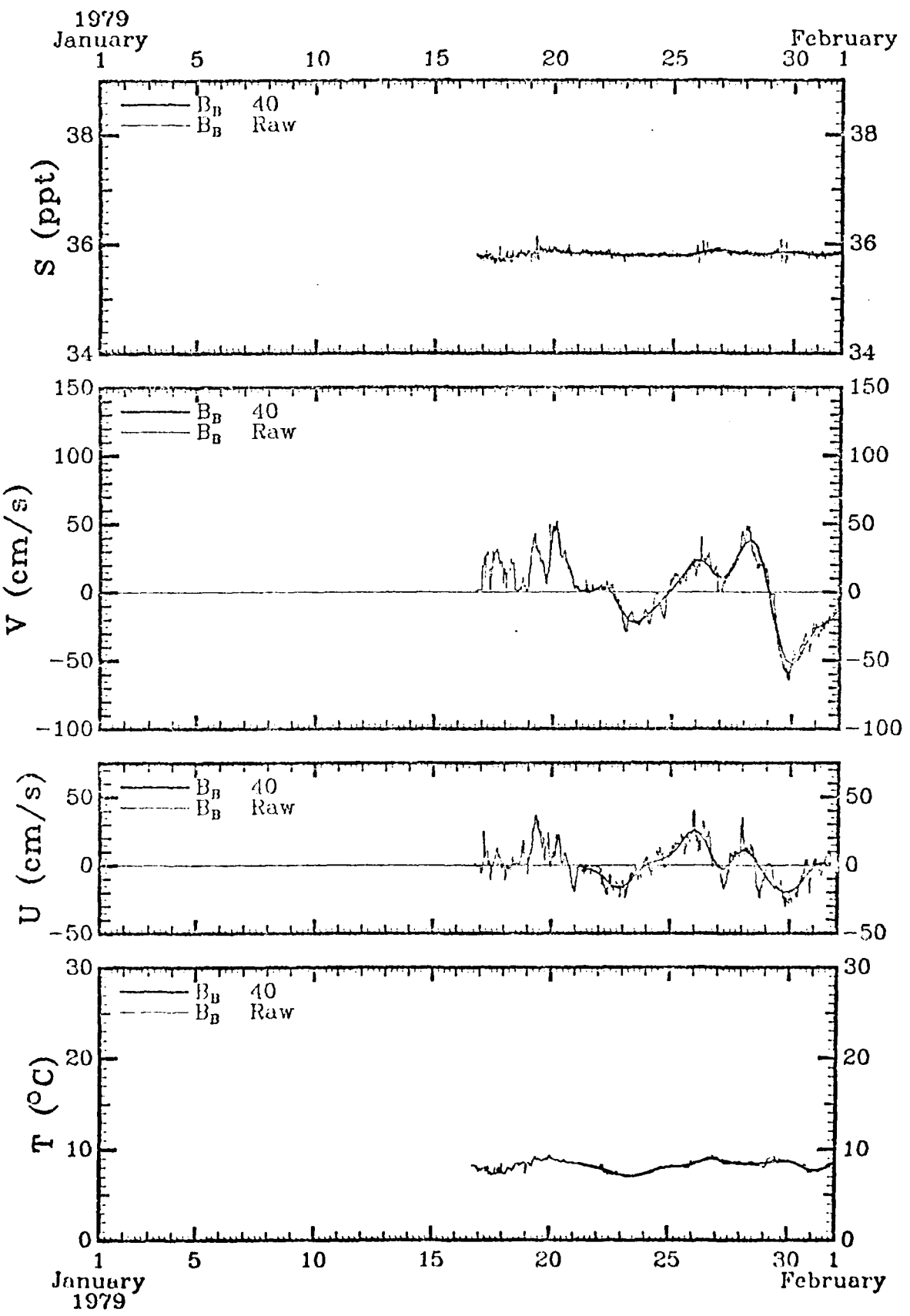
T (°C)
Date/Time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B_B 40
B_B Raw
S (ppt)
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V (cm/s)
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U (cm/s)
T (°C)
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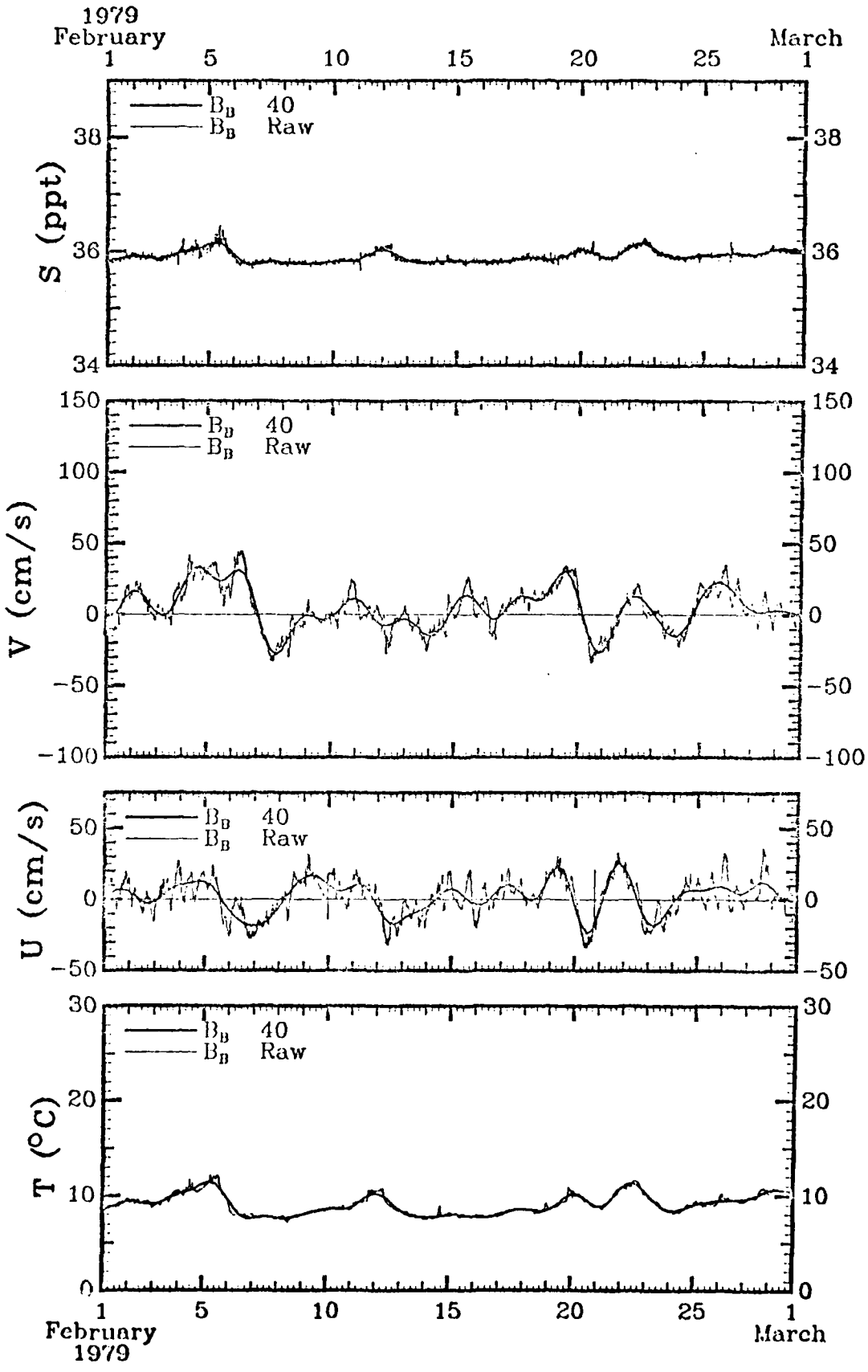
1979
February
Date/Time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B_B 40
B_B Raw
S (ppt)
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V (cm/s)
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U (cm/s)
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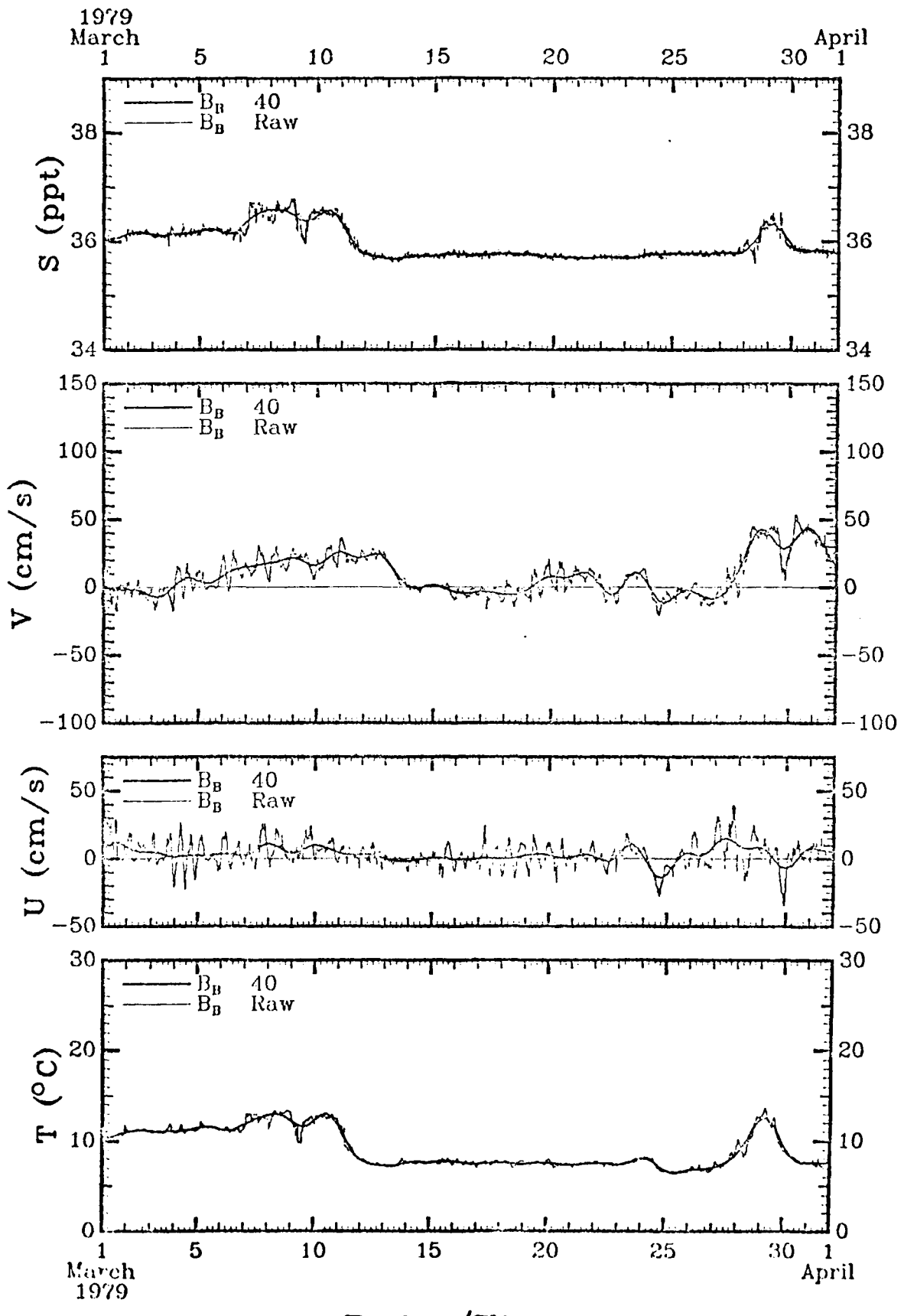
February
1979
March
Date/Time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1
B_B 40
B_B Raw
S (ppt)
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36
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V (cm/s)
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U (cm/s)
T (°C)
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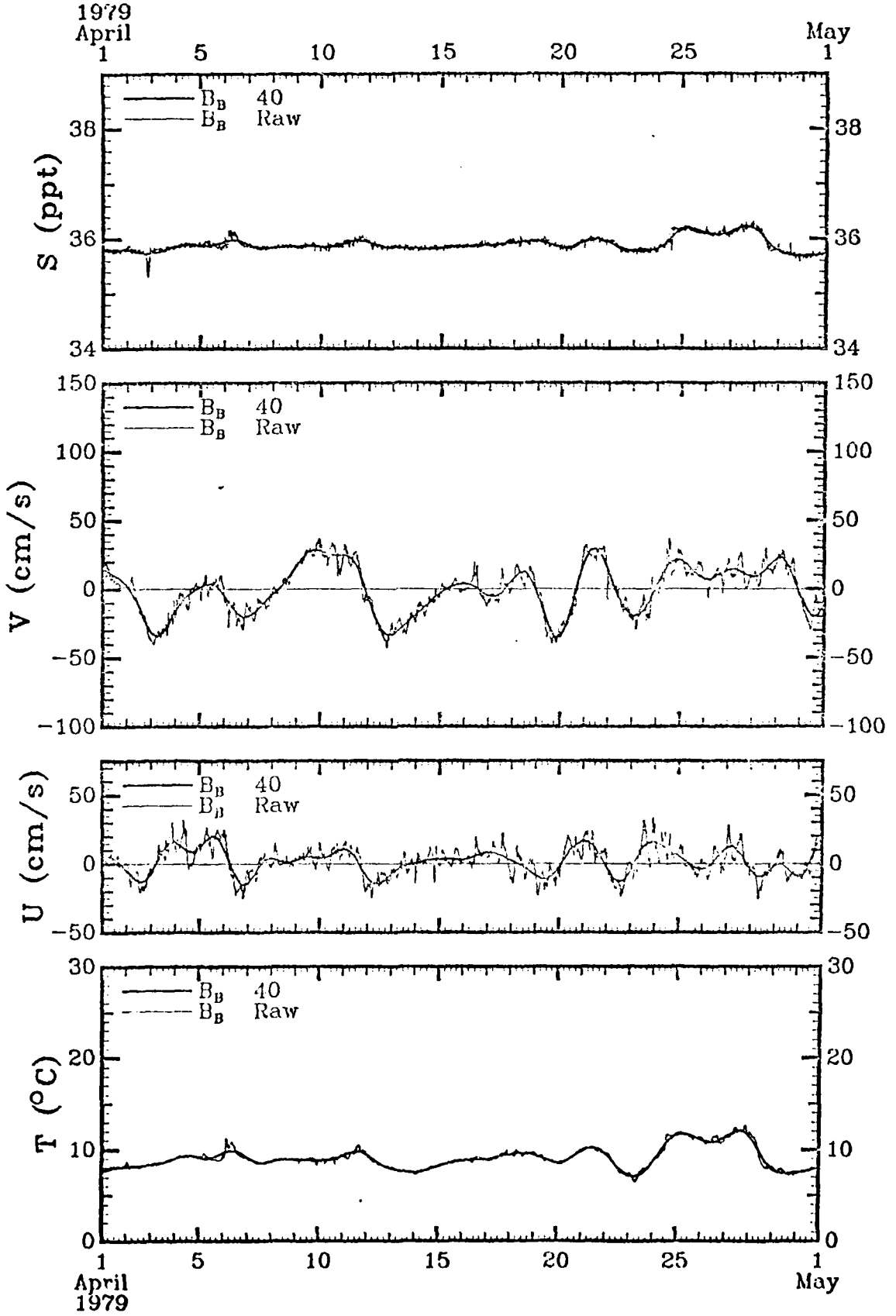
March
1979
April
Date/Time


1979
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B_B 40
B_B Raw
S (ppt)
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V (cm/s)
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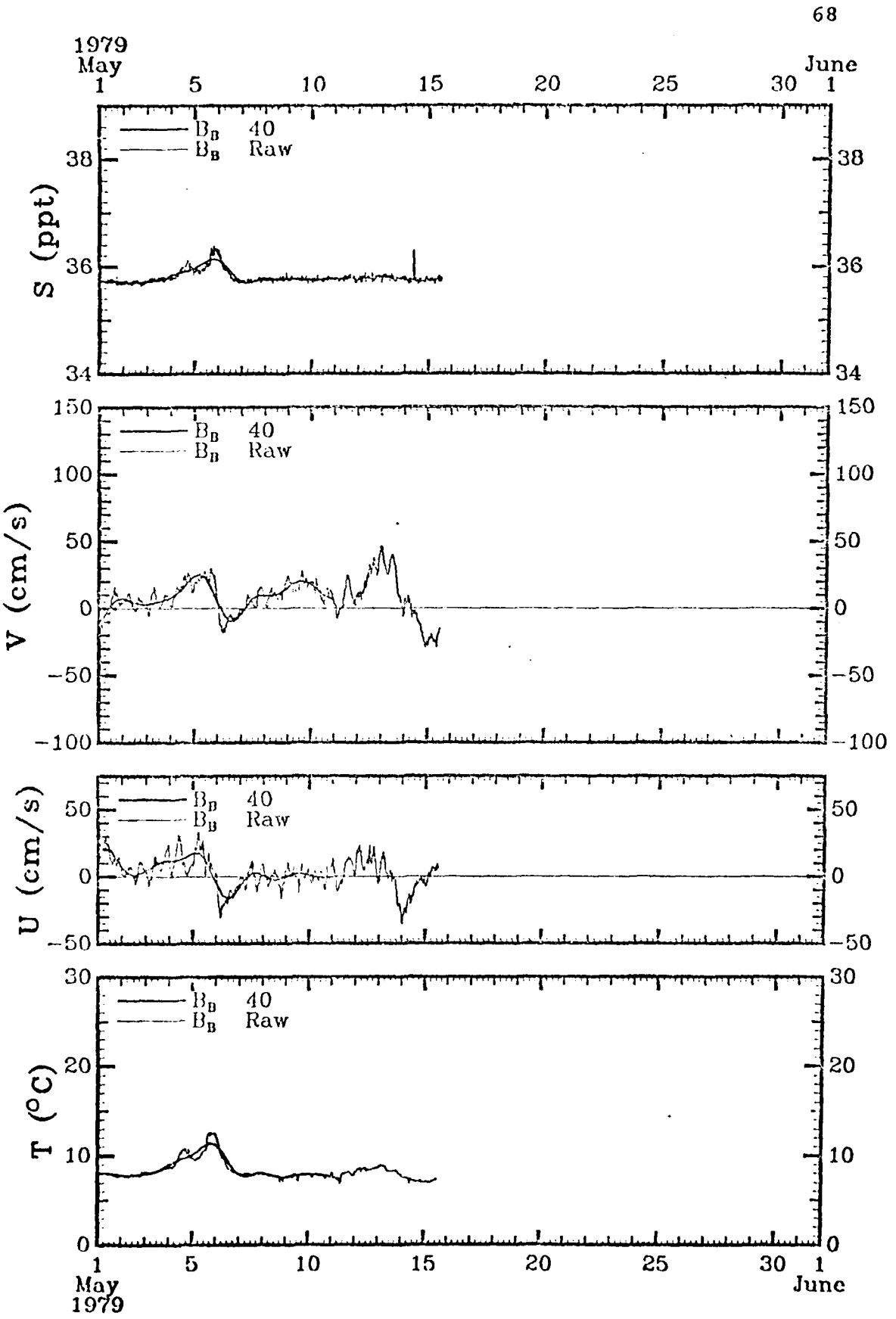
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B_B 40
B_B Raw
S (ppt)
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U (cm/s)
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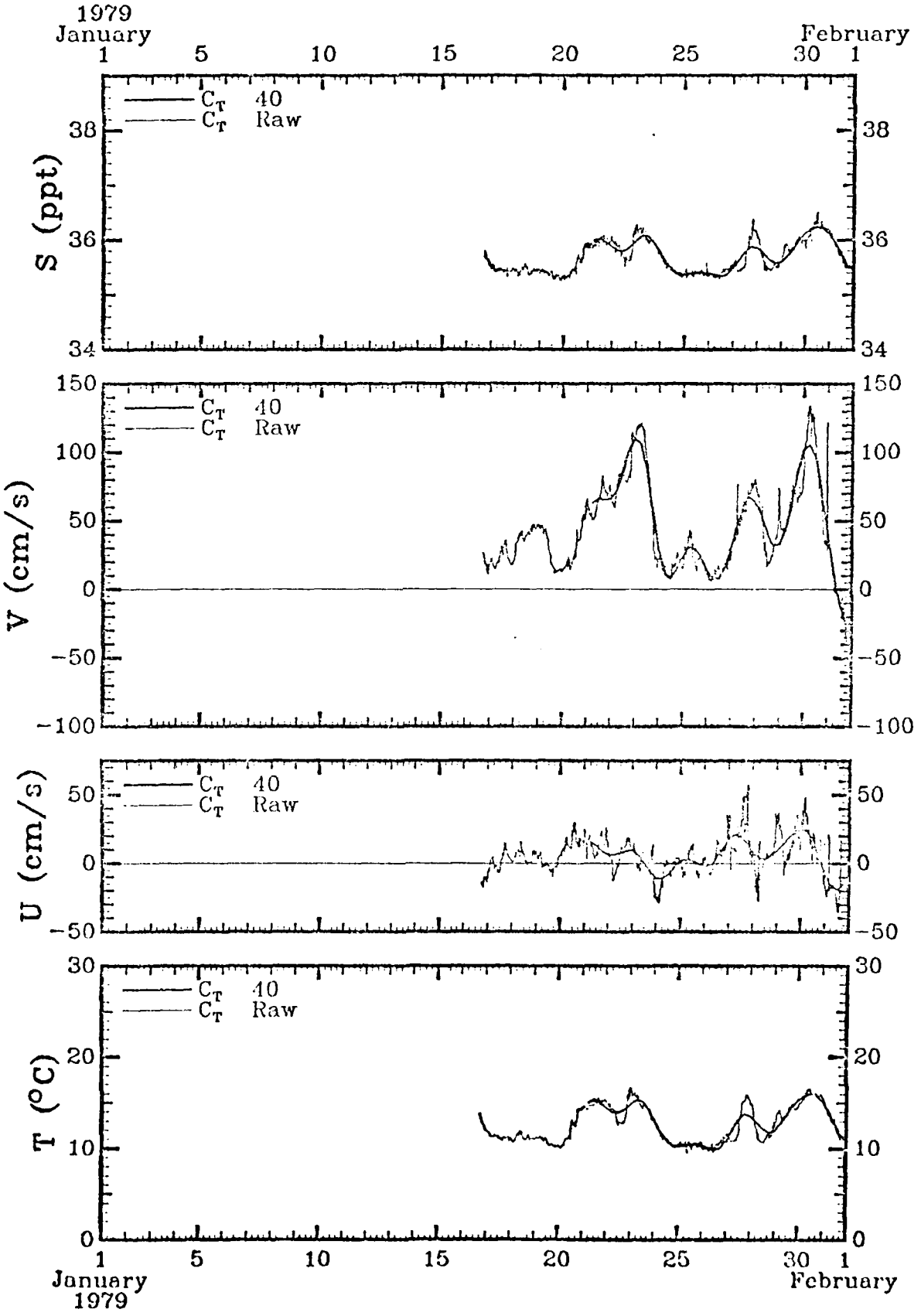
Date/Time


1979
January
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1 5 10 15 20 25 30 1
C_T 40
C_T Raw
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V (cm/s)
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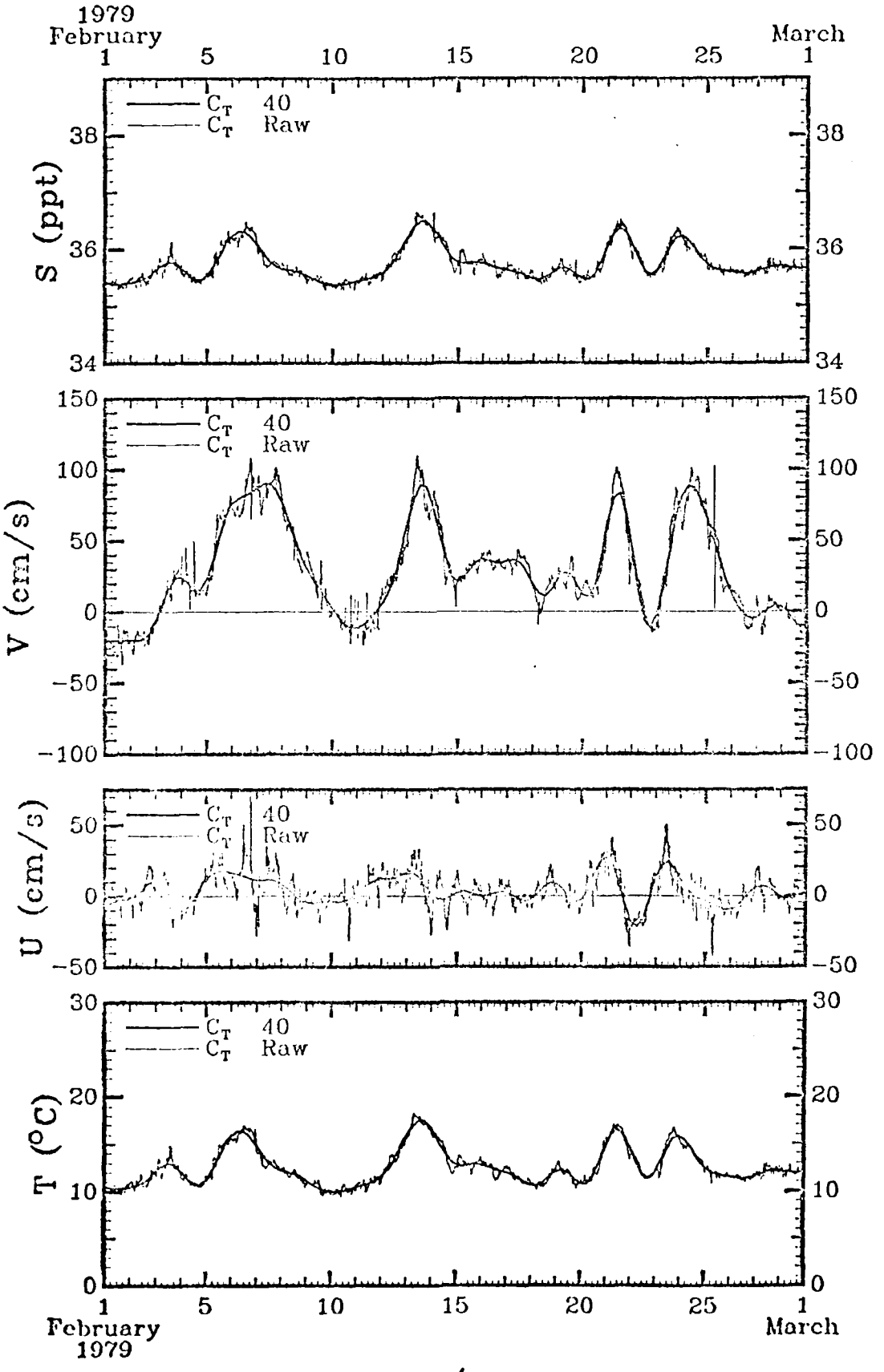
January
1979
February
Date/Time


1979
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C_T 40
C_T Raw
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V (cm/s)
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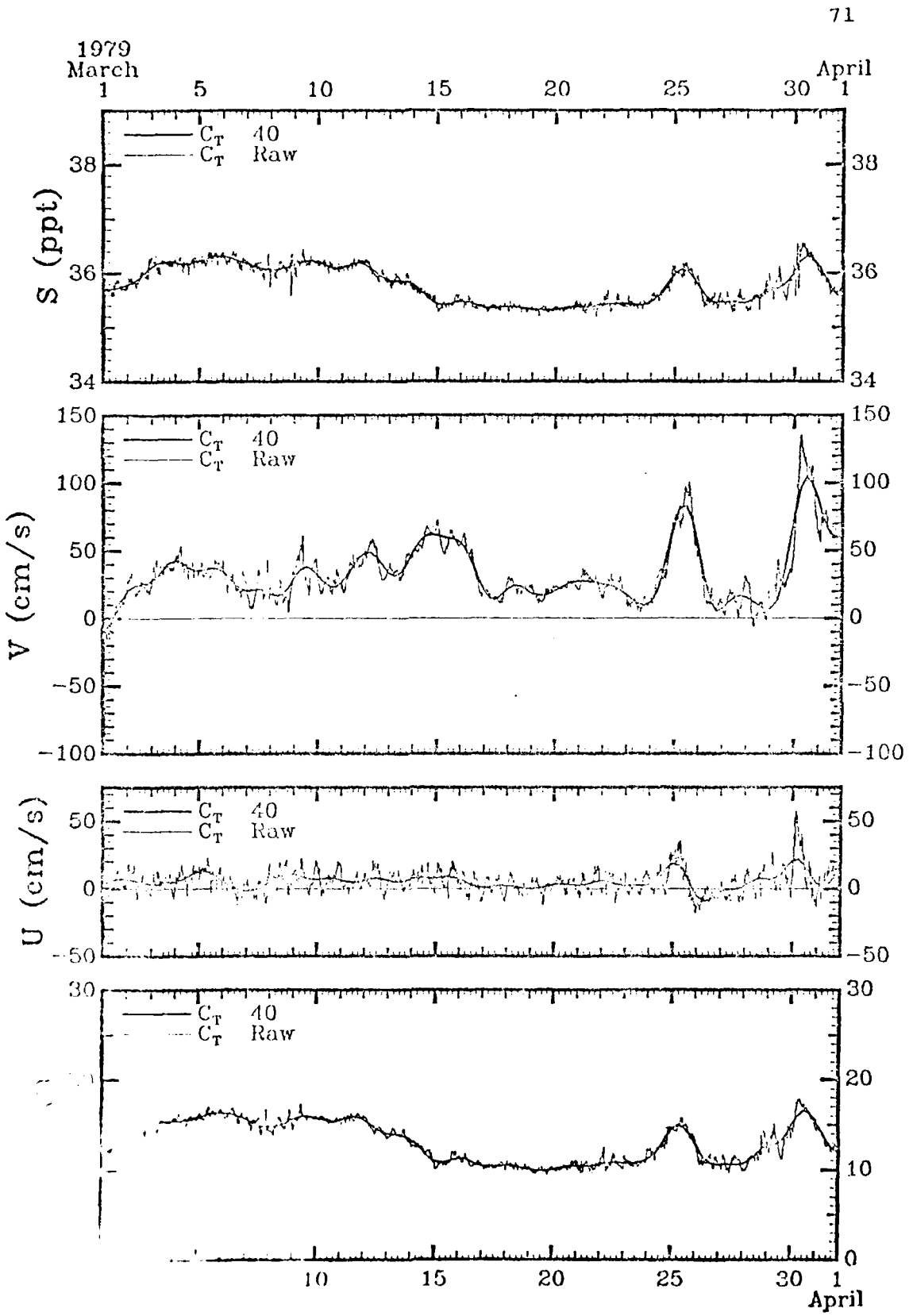
February
1979
March
Date/Time


1979
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C_T 40
C_T Raw
S (ppt)
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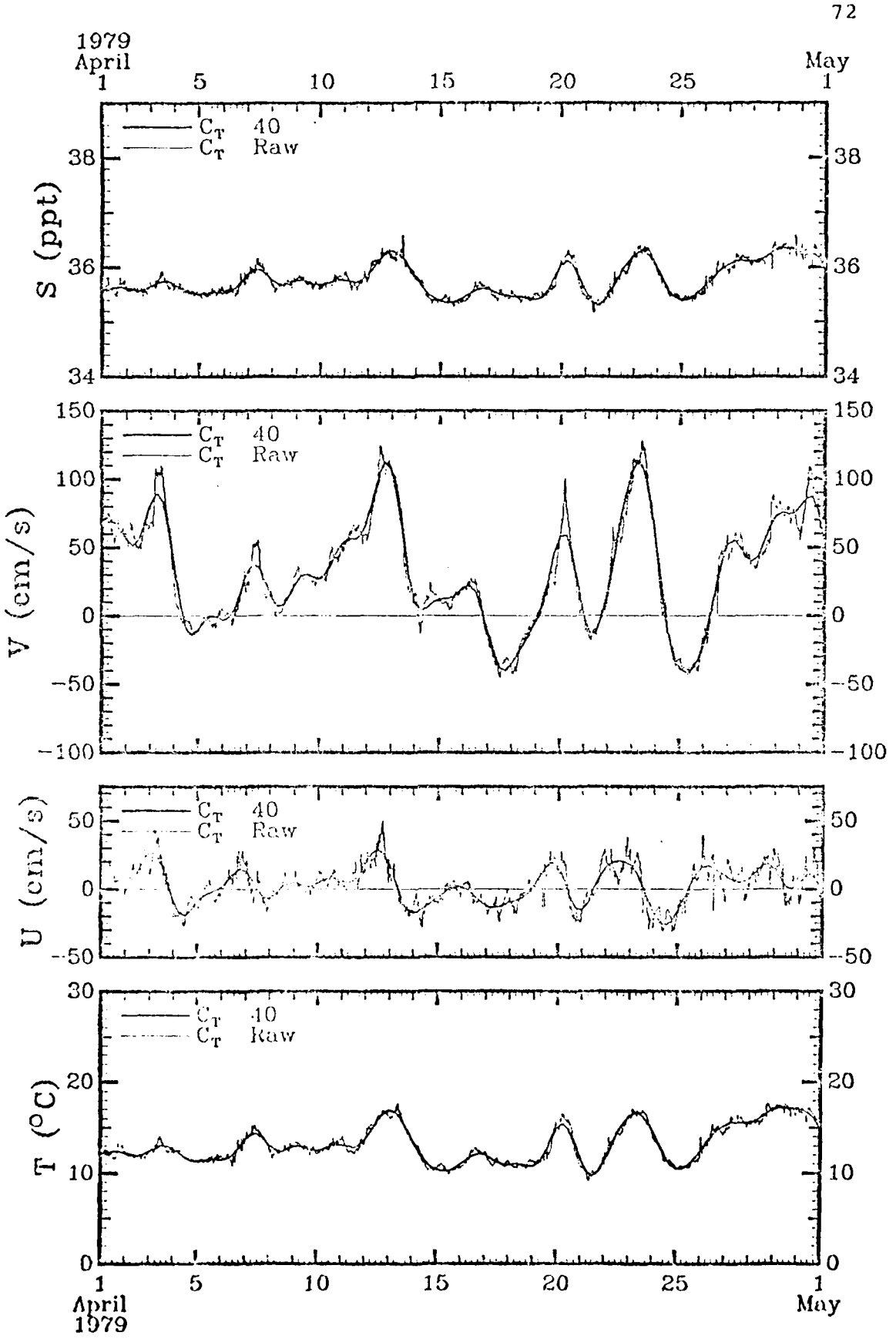
Date/Time


1979
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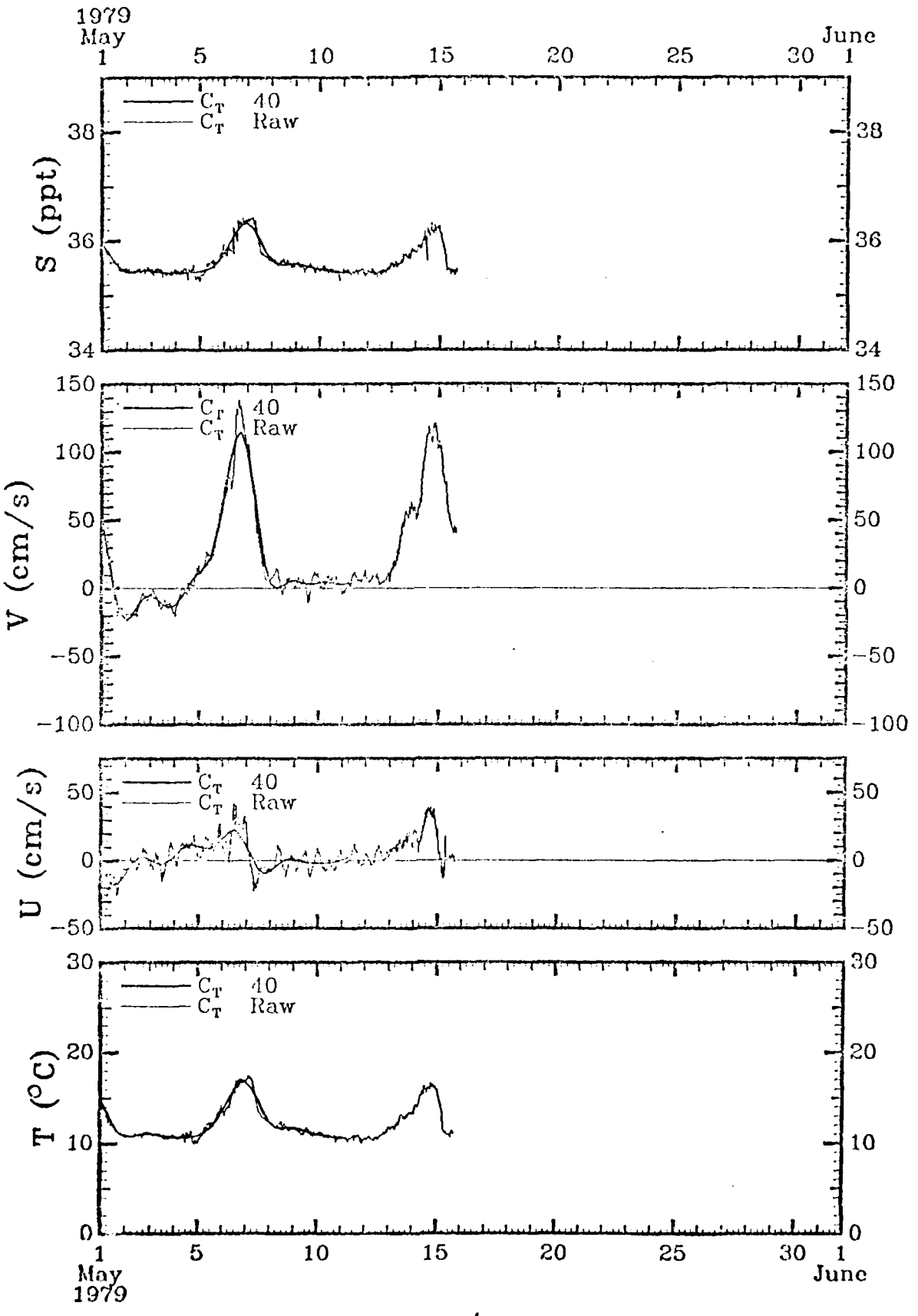
1979
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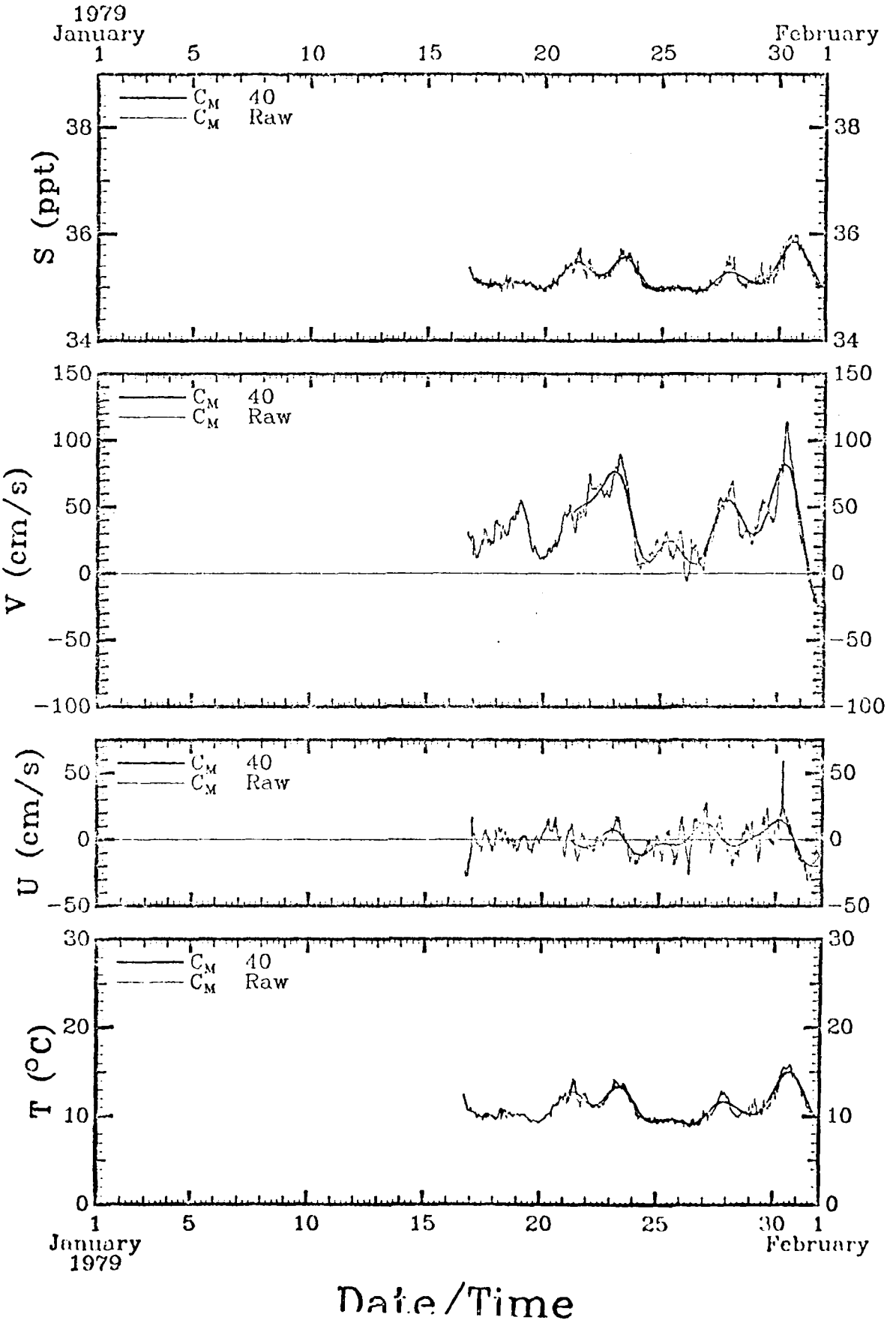
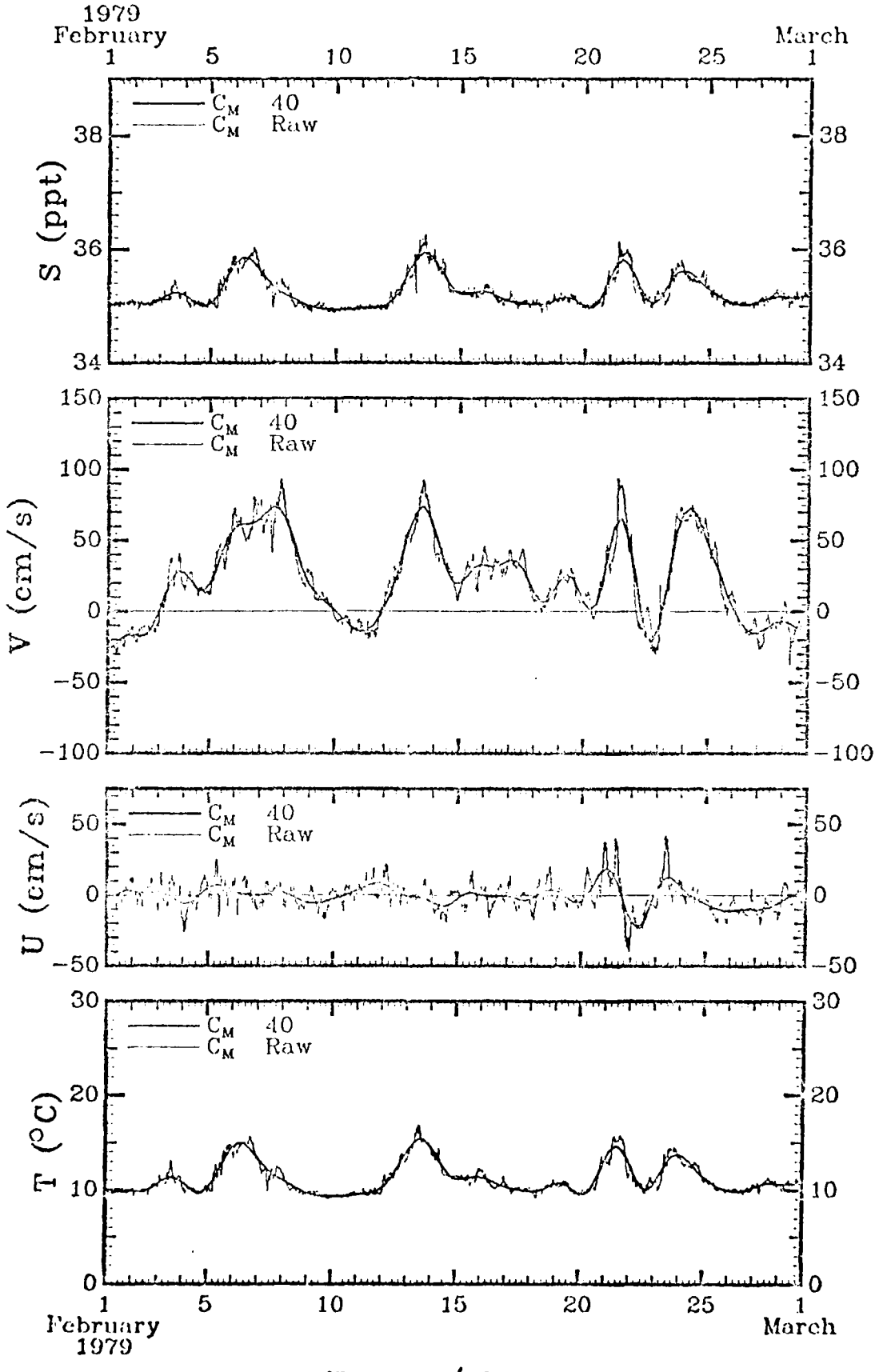
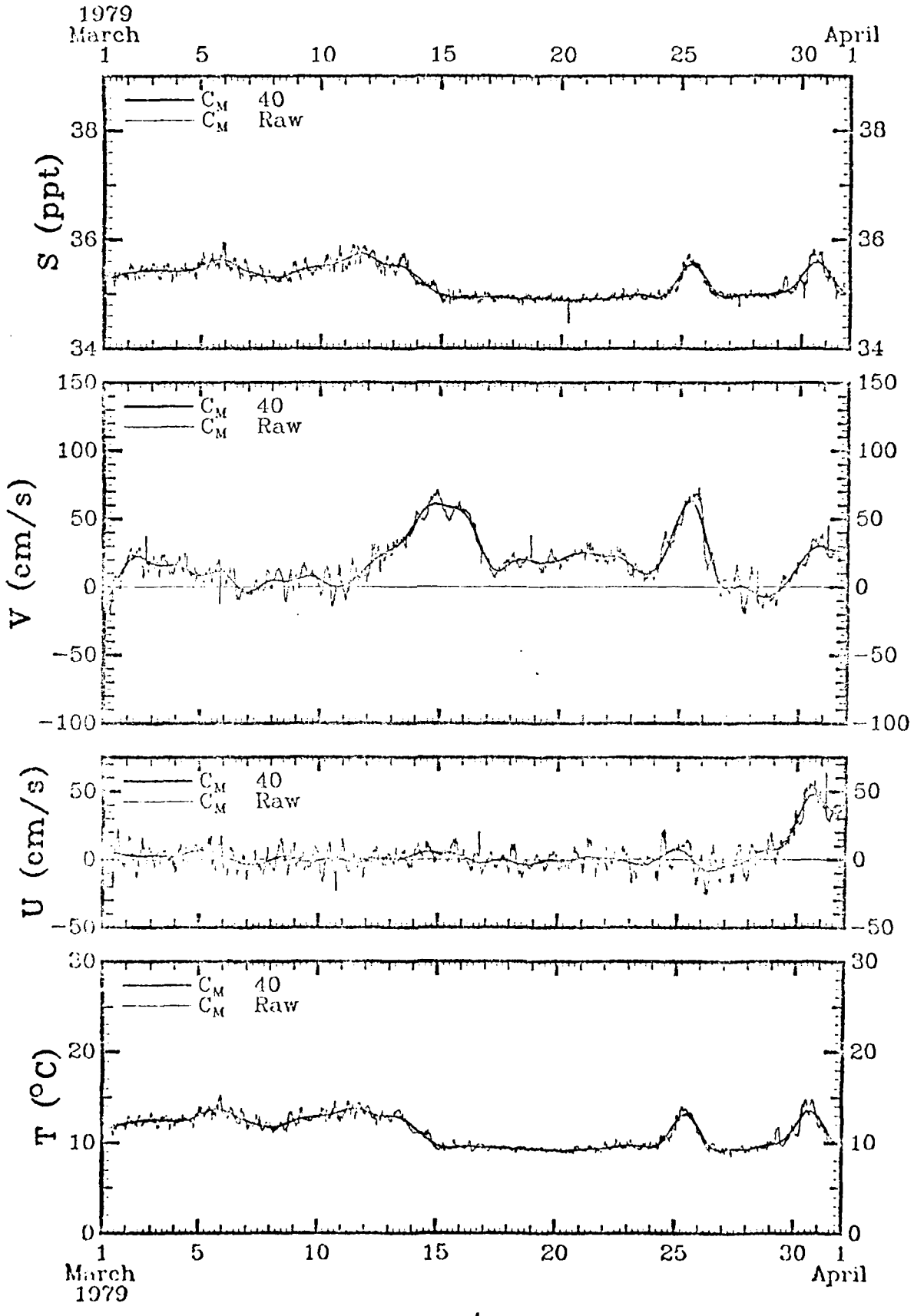
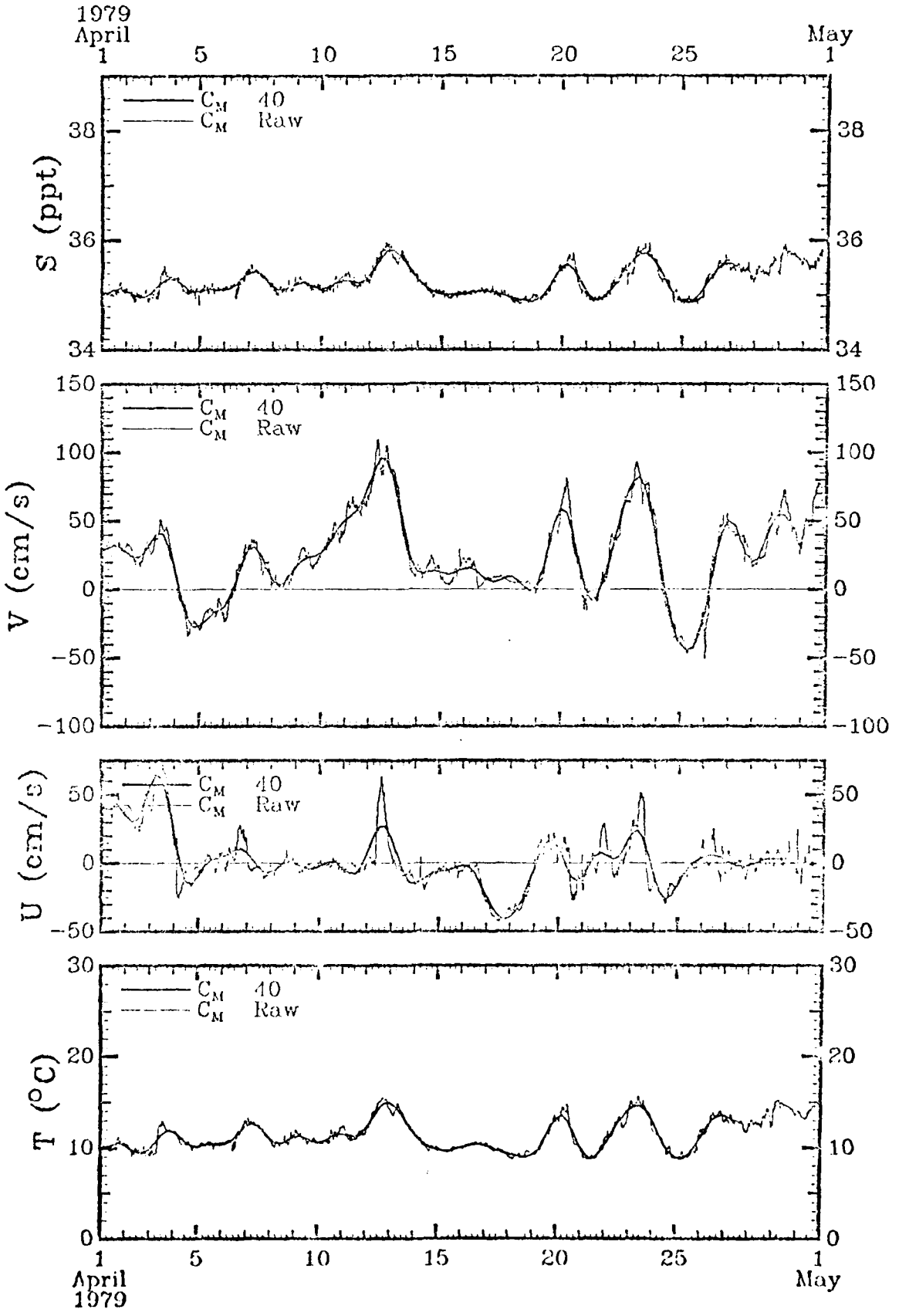
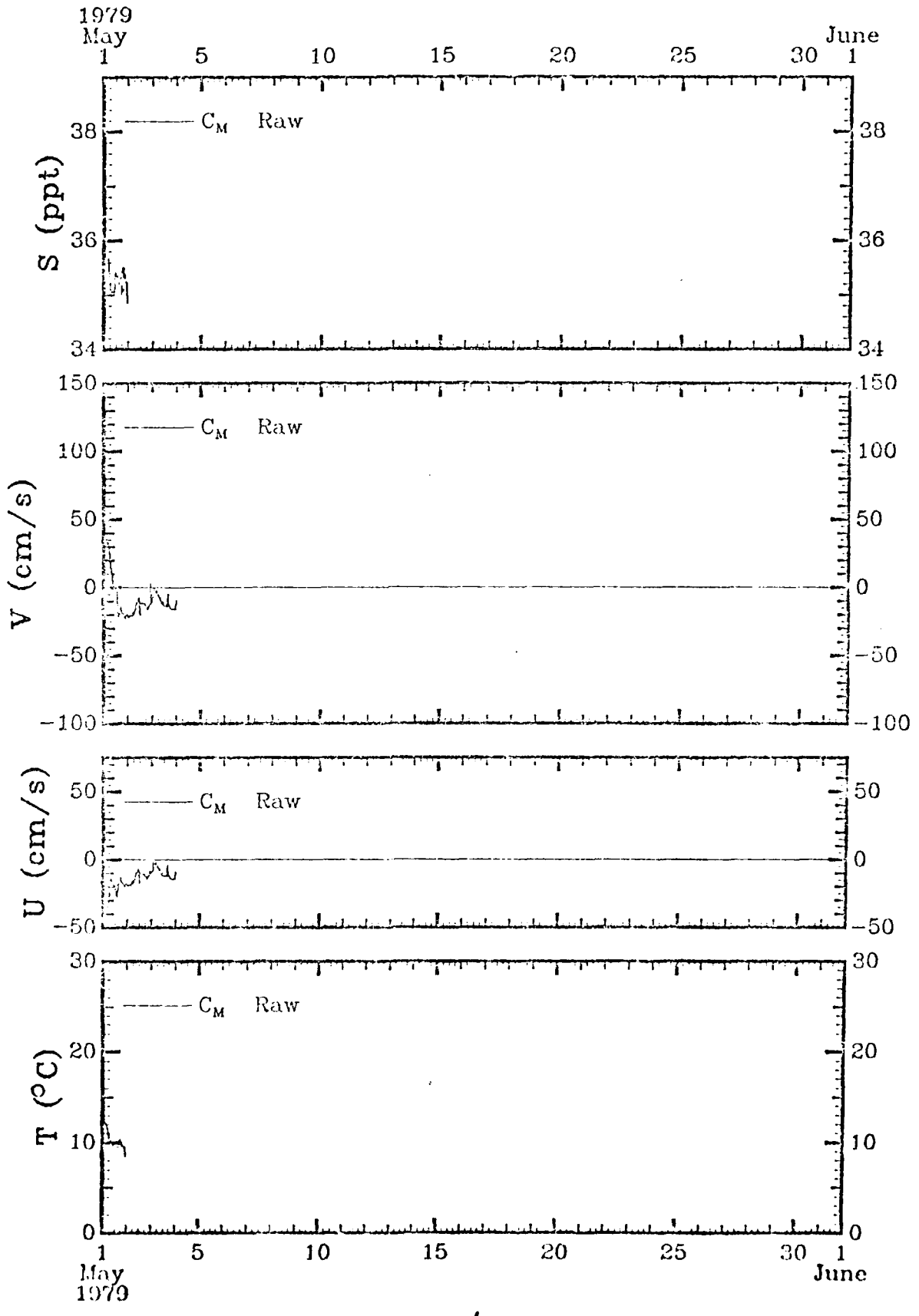
T (°C)
Date/Time

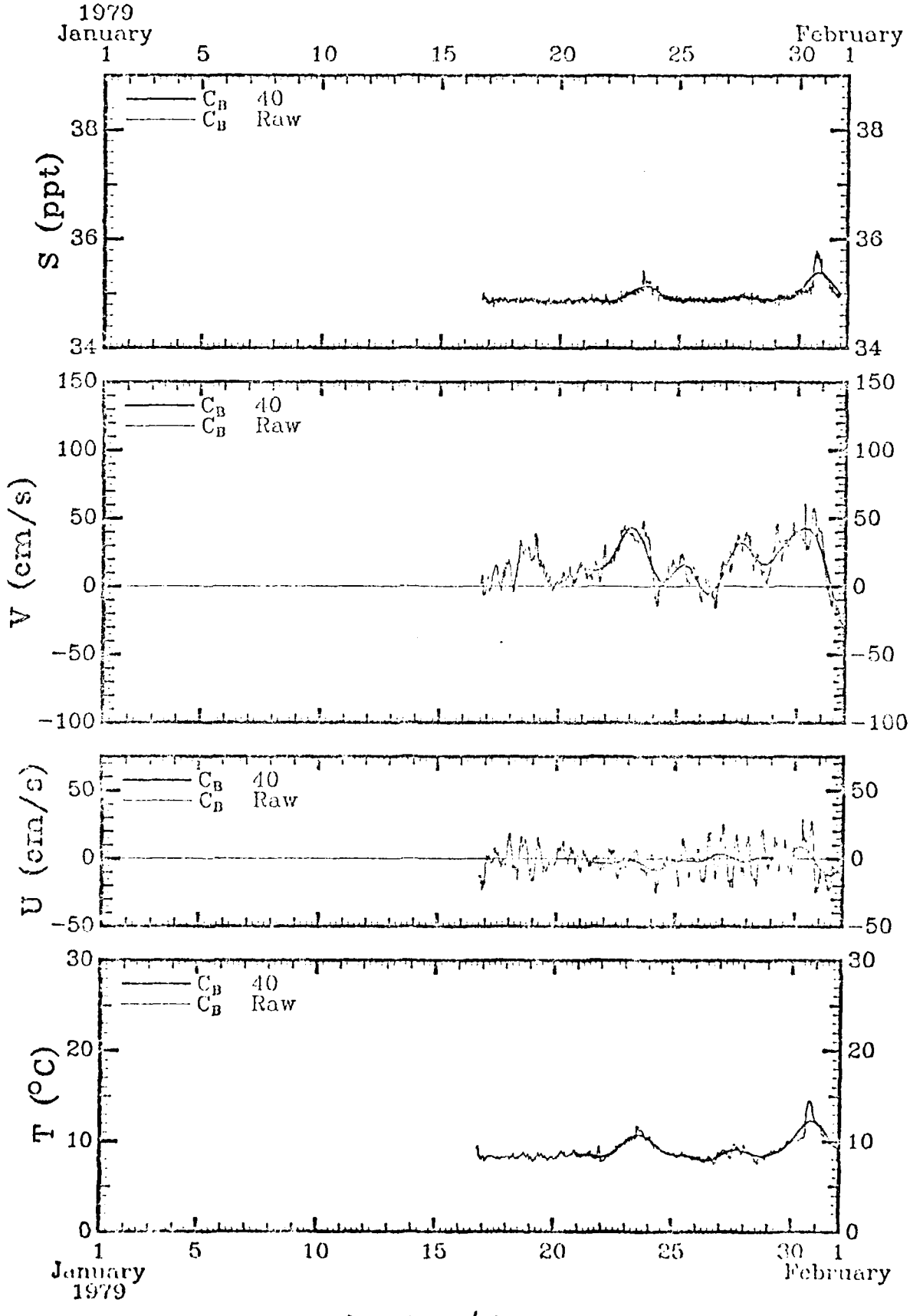

1979
January
February
1 5 10 15 20 25 30 1
C_M 40
C_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time

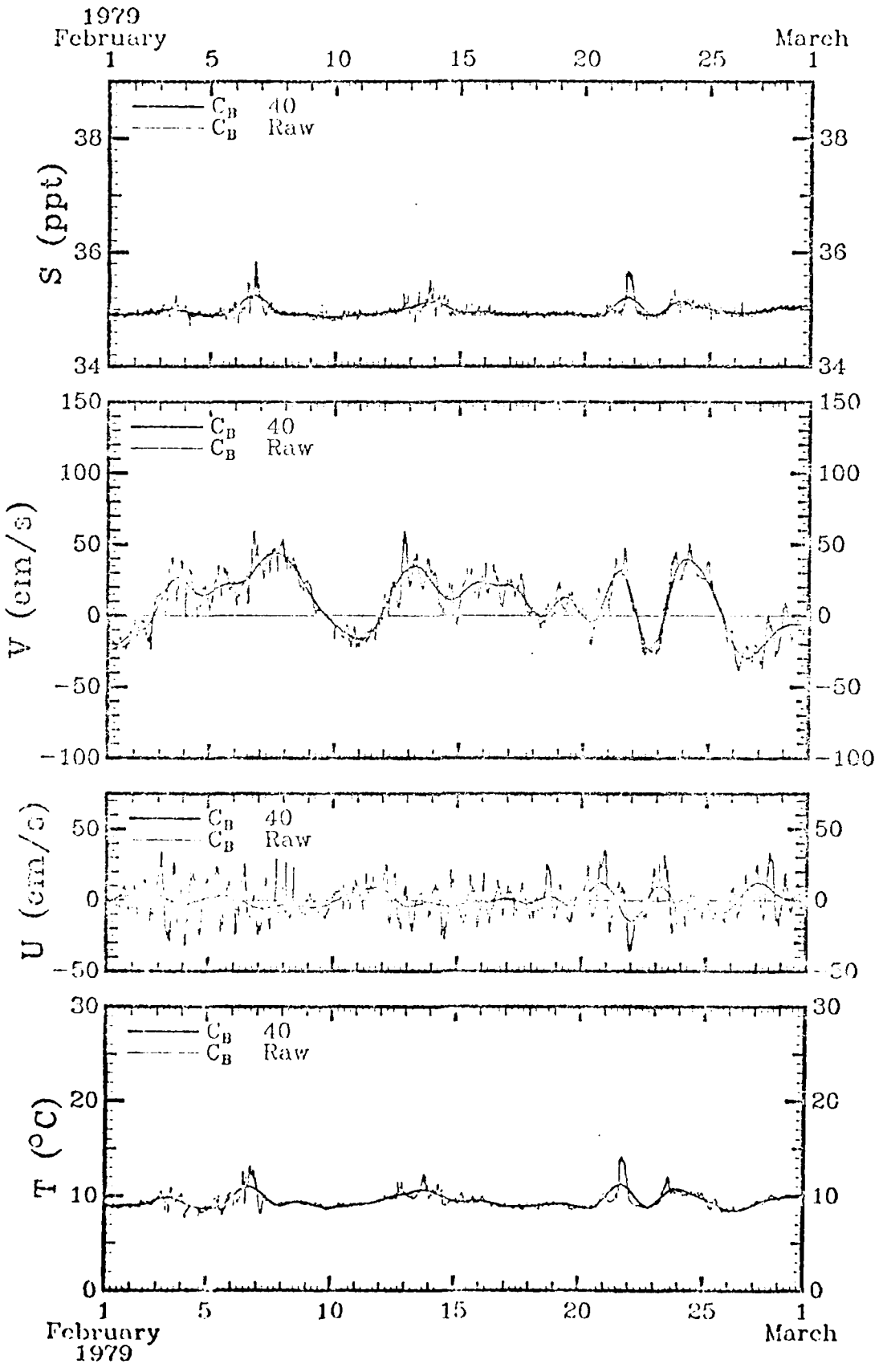

1979
February
March
1
5
10
15
20
25
1
C_M 40
C_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
February
1979
March
Date/Time

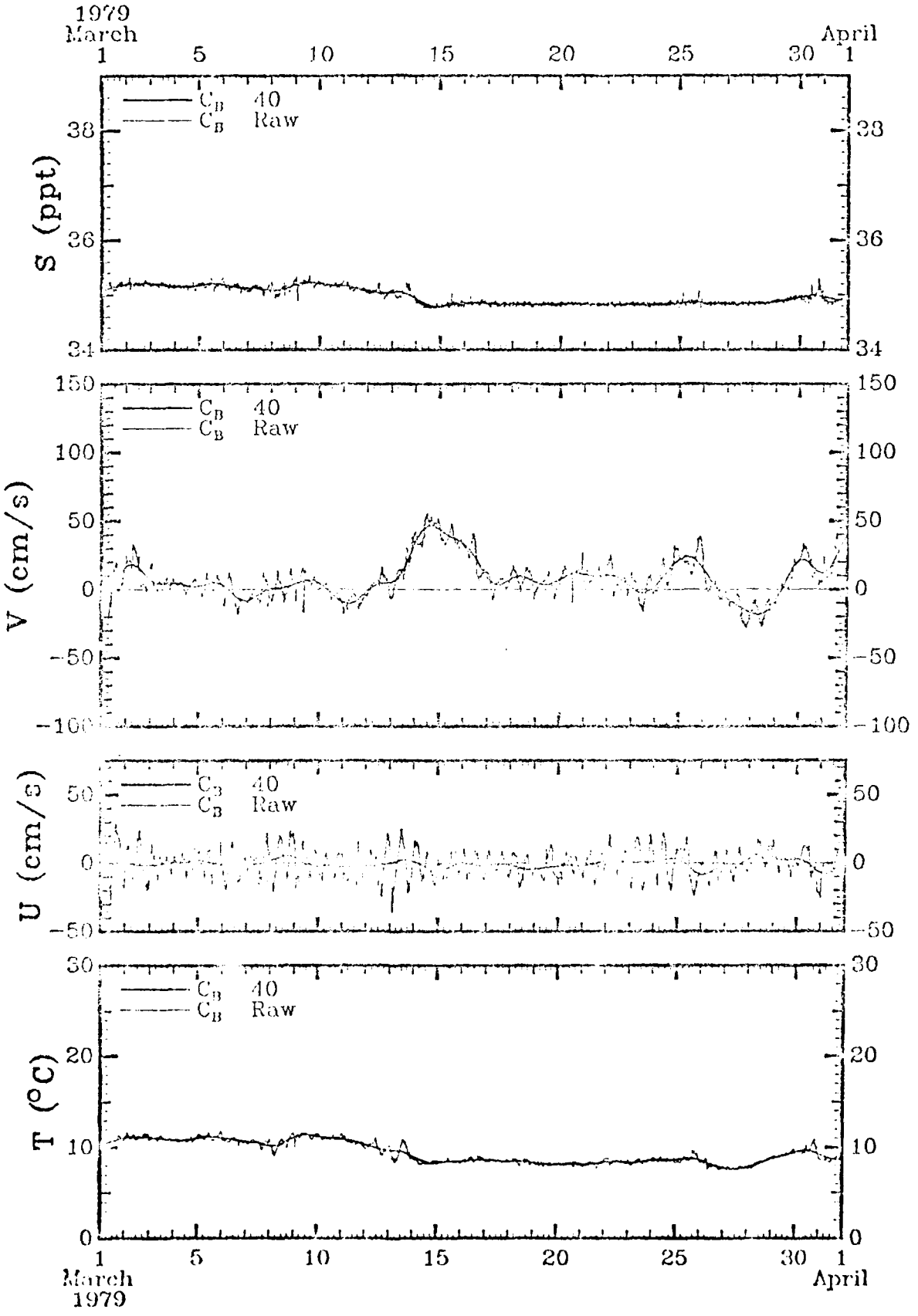

1979
March
April
1
5
10
15
20
25
30
1
C_M 40
C_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
March
1979
April
Date/Time

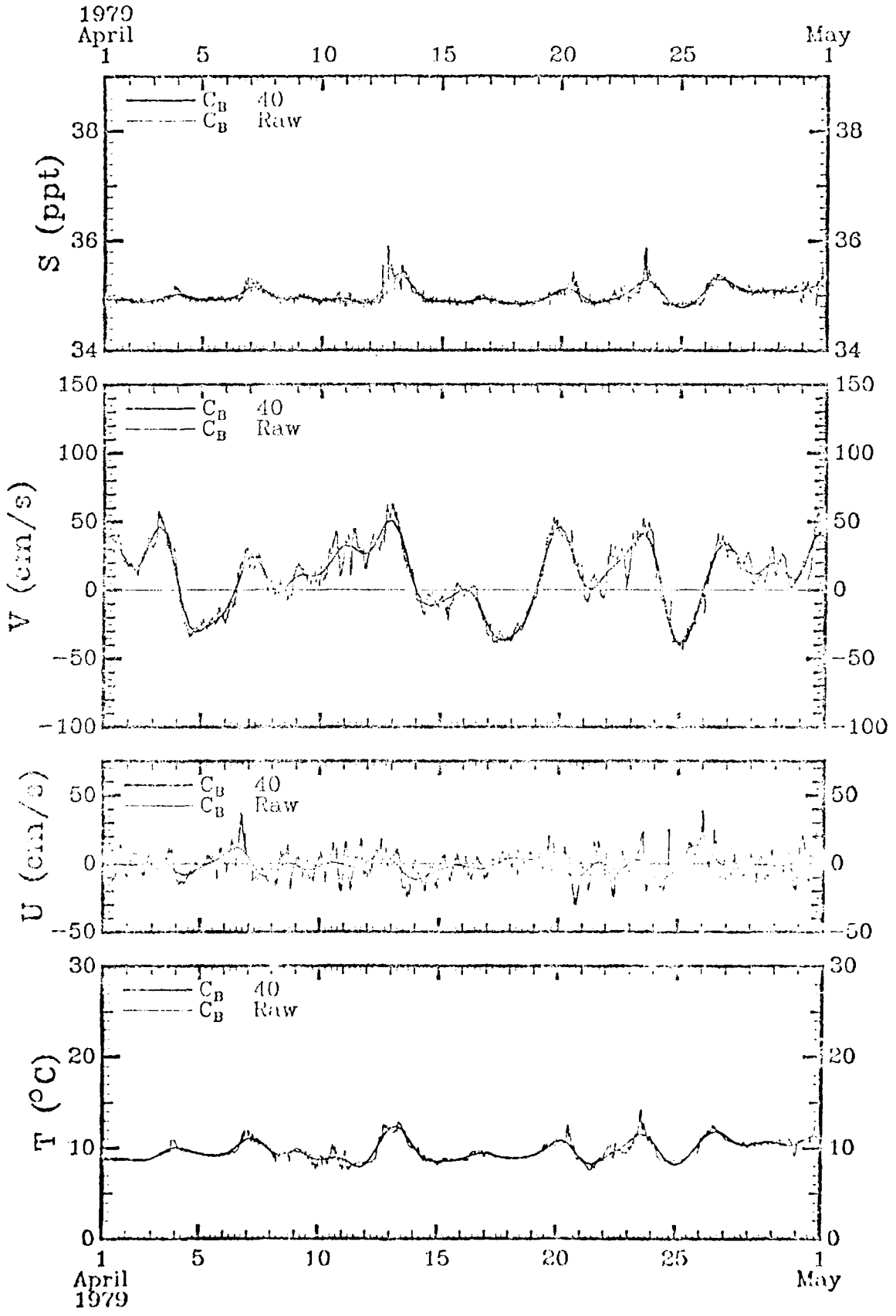

1979
April
May
1
5
10
15
20
25
1
C_M 40
C_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
April
1979
Date/Time

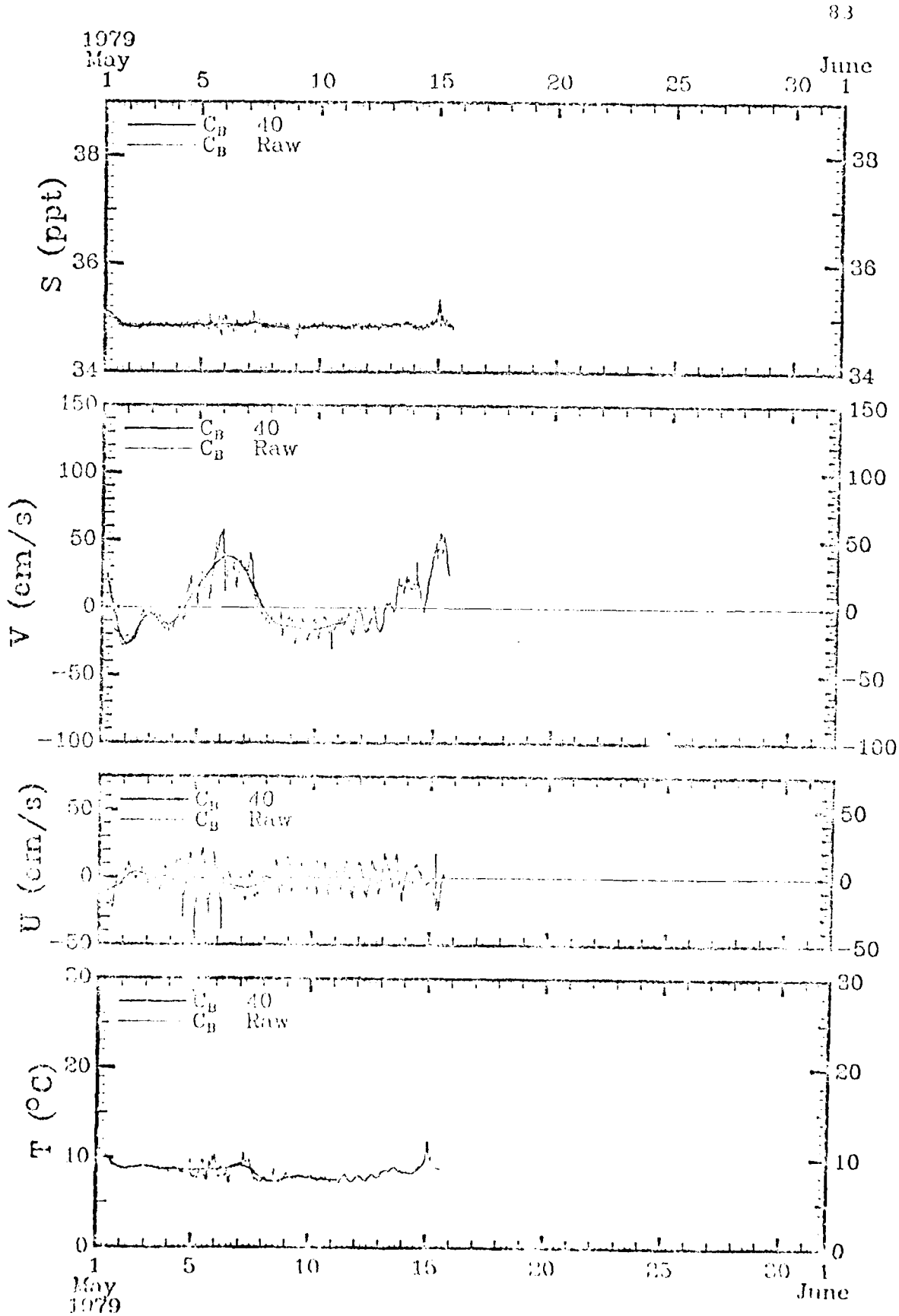

1979
May
1
5
10
15
20
25
30
June
1
S (ppt)
38
36
34
C_M Raw
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
May
1979
June
Date/Time

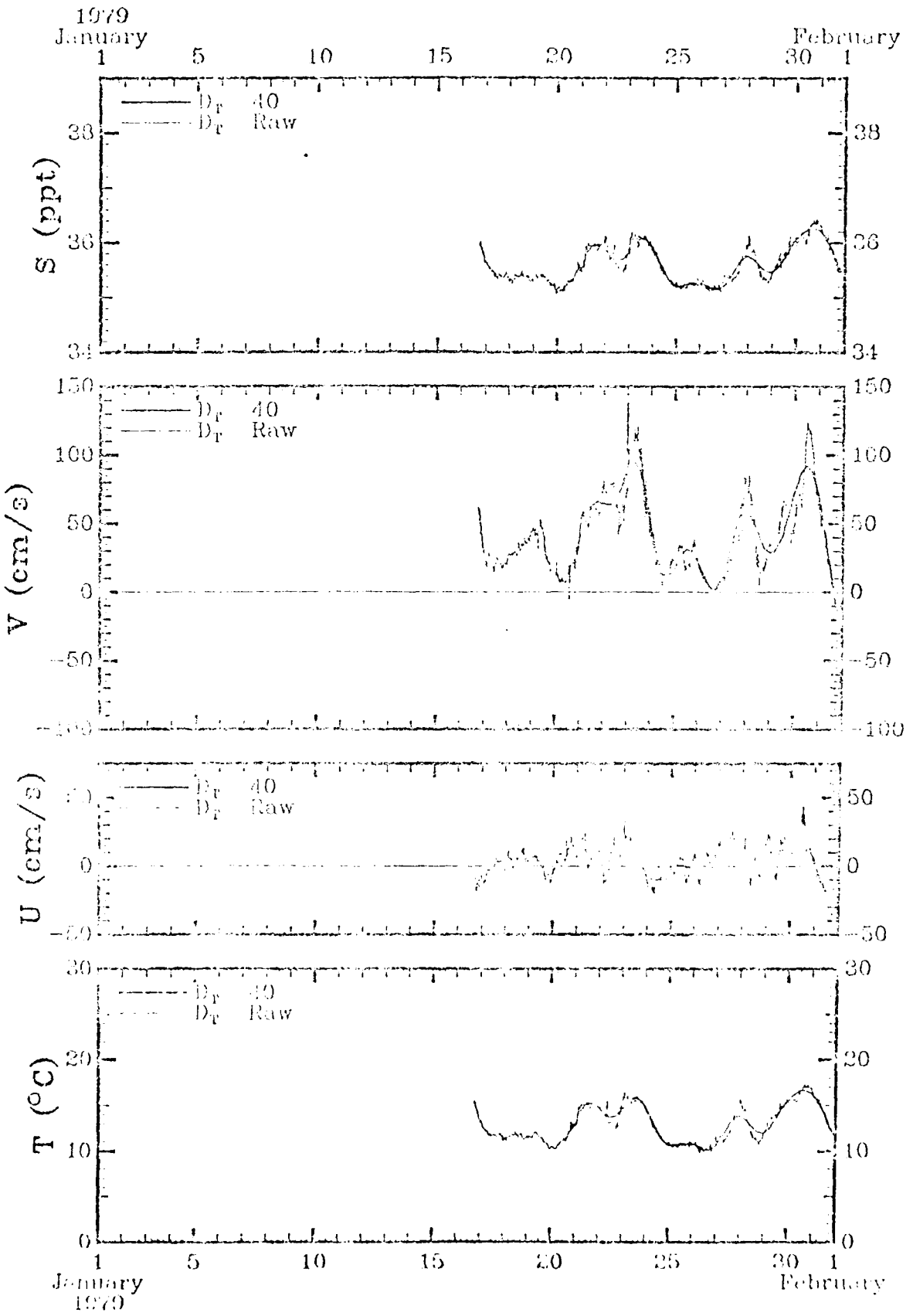

1979
January
February
1
5
10
15
20
25
30
1
C_B 40
C_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
C_B 40
C_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
February
1979
March
Date/Time


1979
March
April
1
5
10
15
20
25
30
1
C_B 40
C_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
April
Date/Time

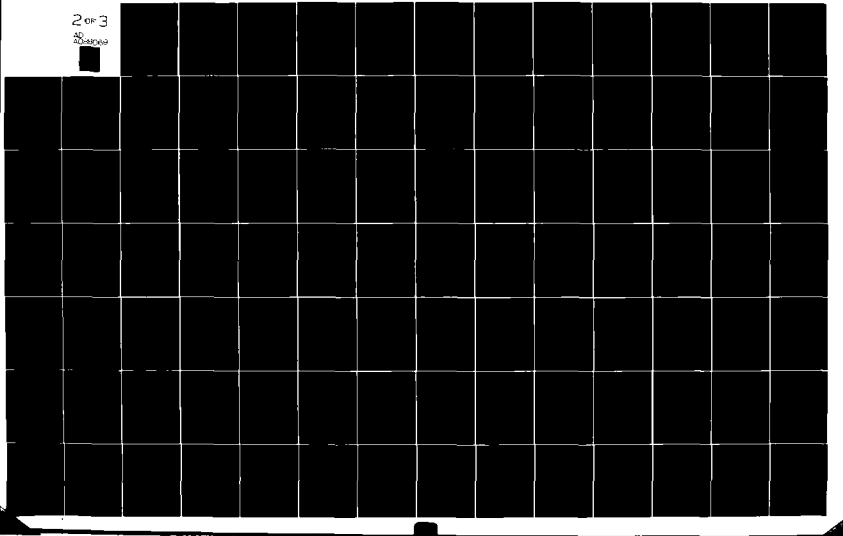

1979
April
May
1
5
10
15
20
25
1
C_B 40
C_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
April
1979
May
Date/Time

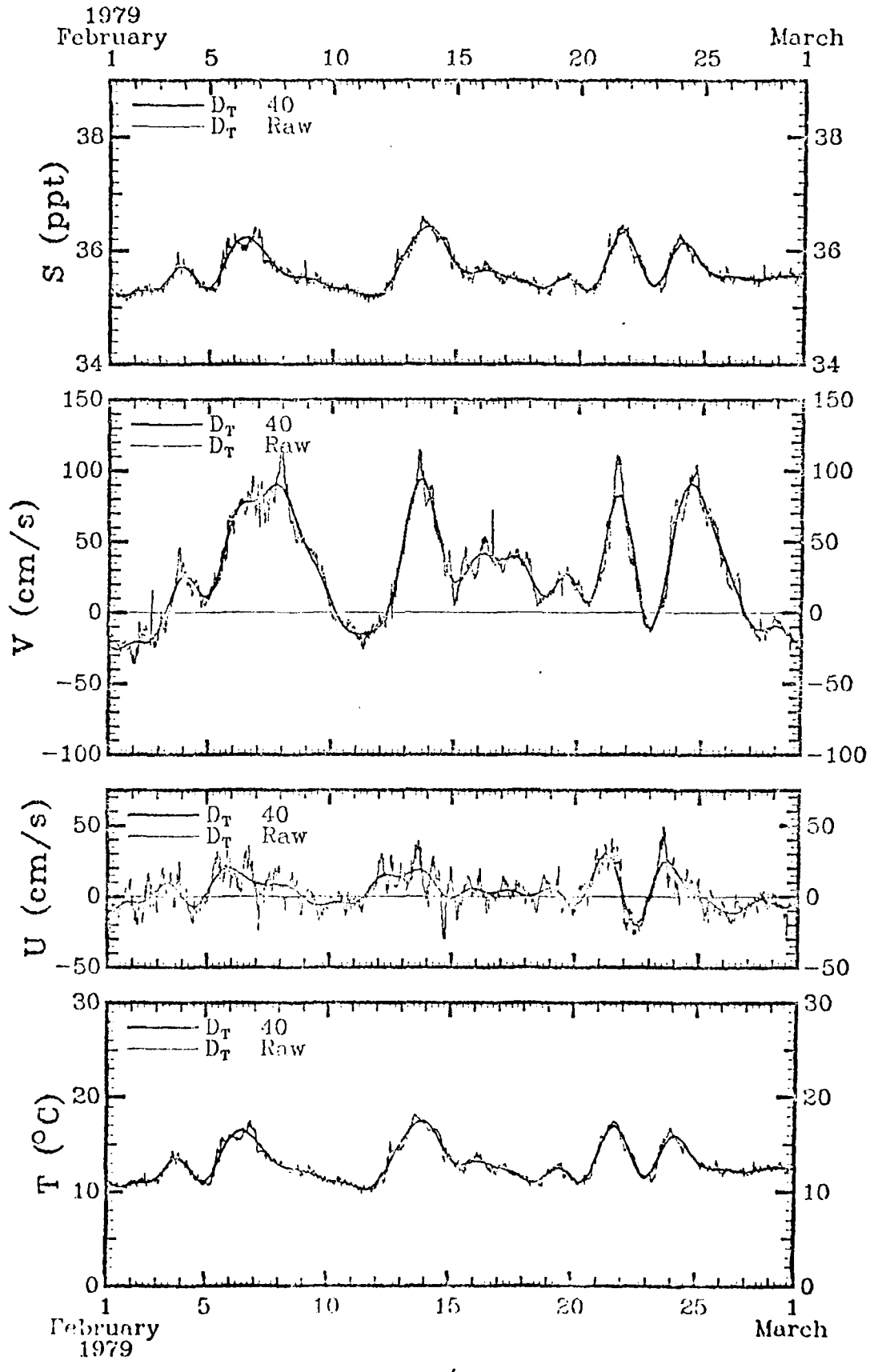

1979
May
1
5
10
15
20
25
30
June
1
C_B 40
C_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
May
1979
June
Date/Time

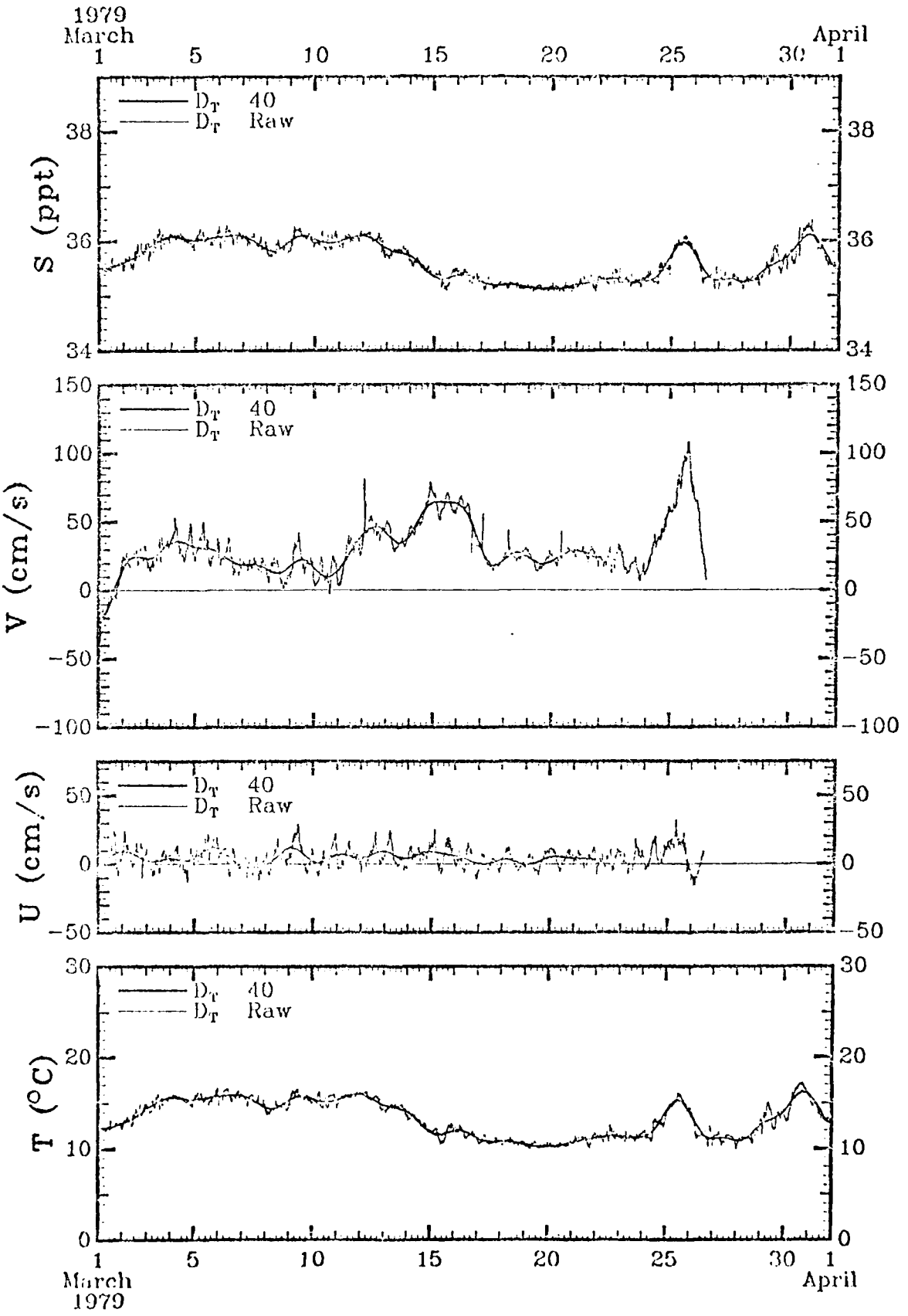

1979
January
February
1
5
10
15
20
25
30
1
D_f 40
D_f Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
Date/Time

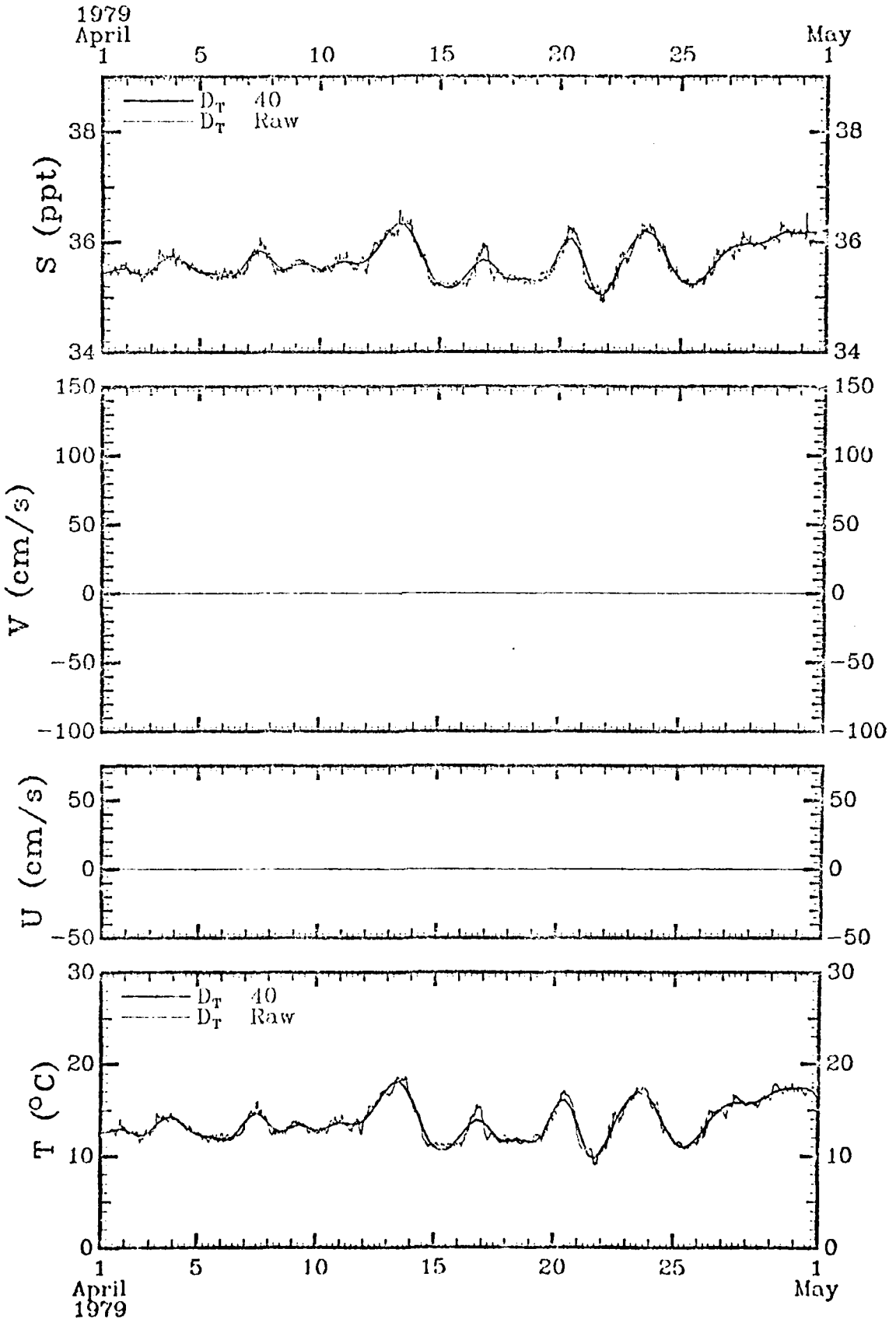
AD-A088 069 TEXAS A AND M UNIV COLLEGE STATION DEPT OF OCEANOGRAPHY F/G 8/3
THE GULF STREAM MEANDERS EXPERIMENT, CURRENT METER, ATMOSPHERIC--ETC(U)
JUL 80 D A BROOKS, J M BANE, R L COHEN N00014-77-C-0354
UNCLASSIFIED TAMU-REF-80-7-T NL

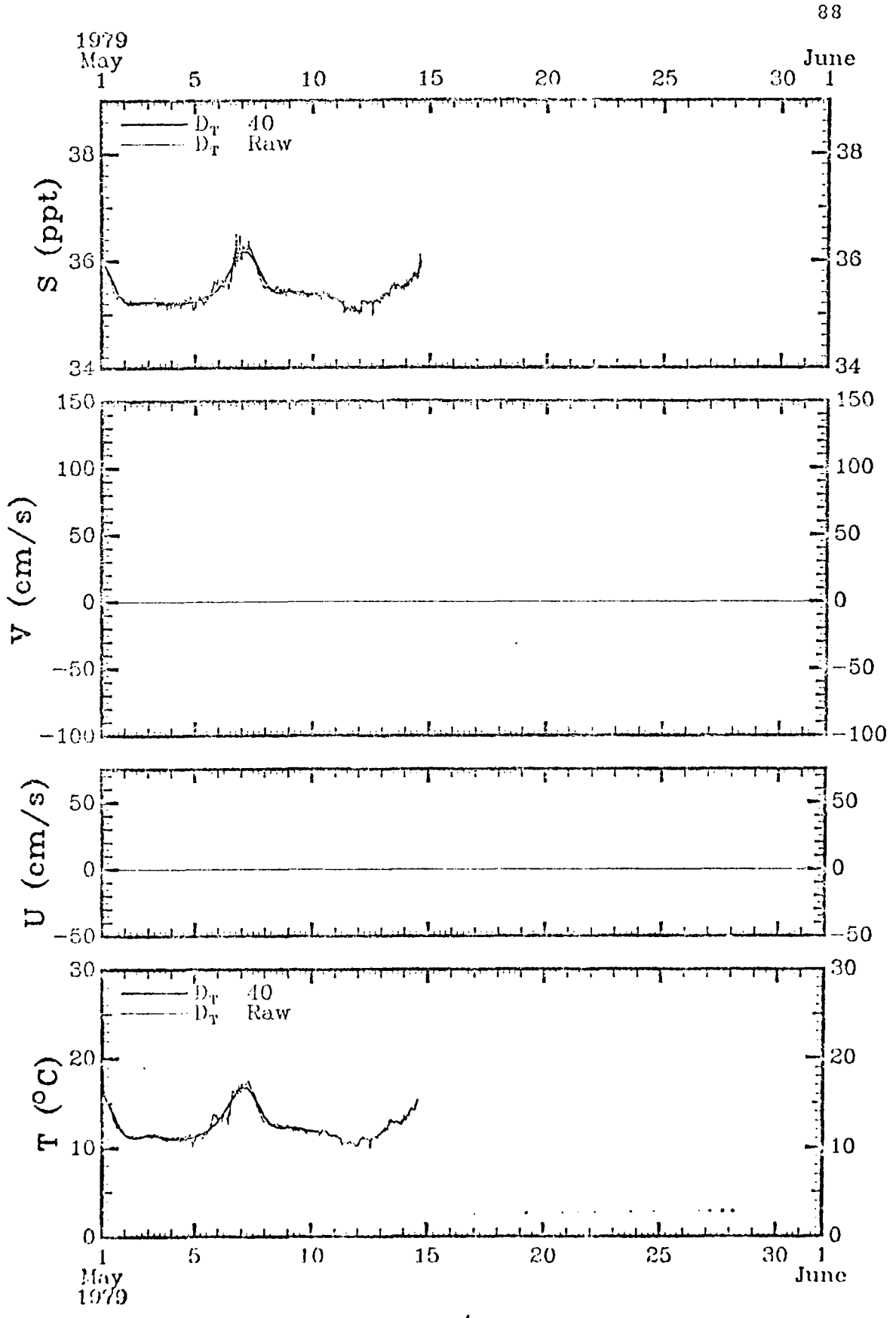
2 OF 3
AD A088069

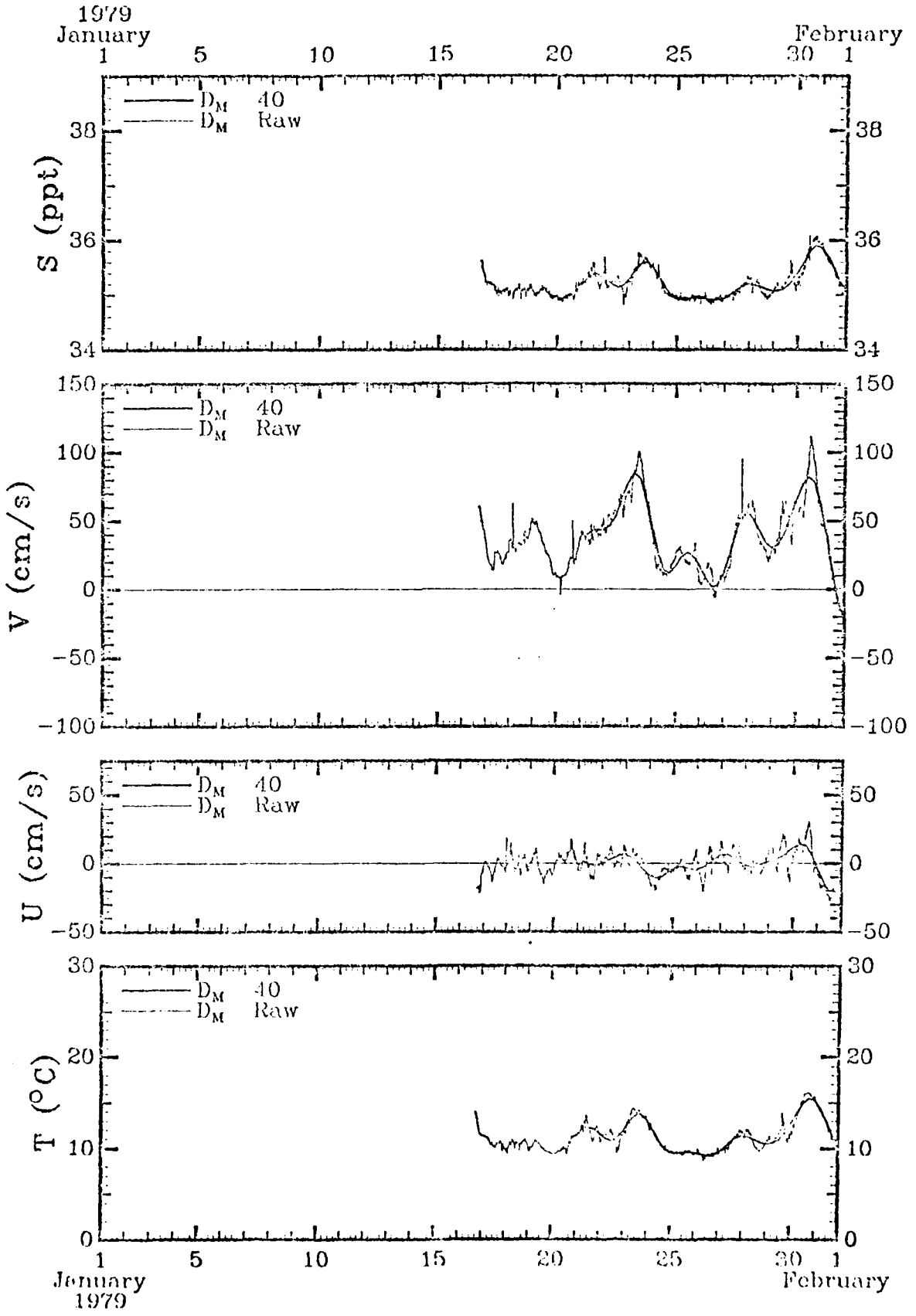


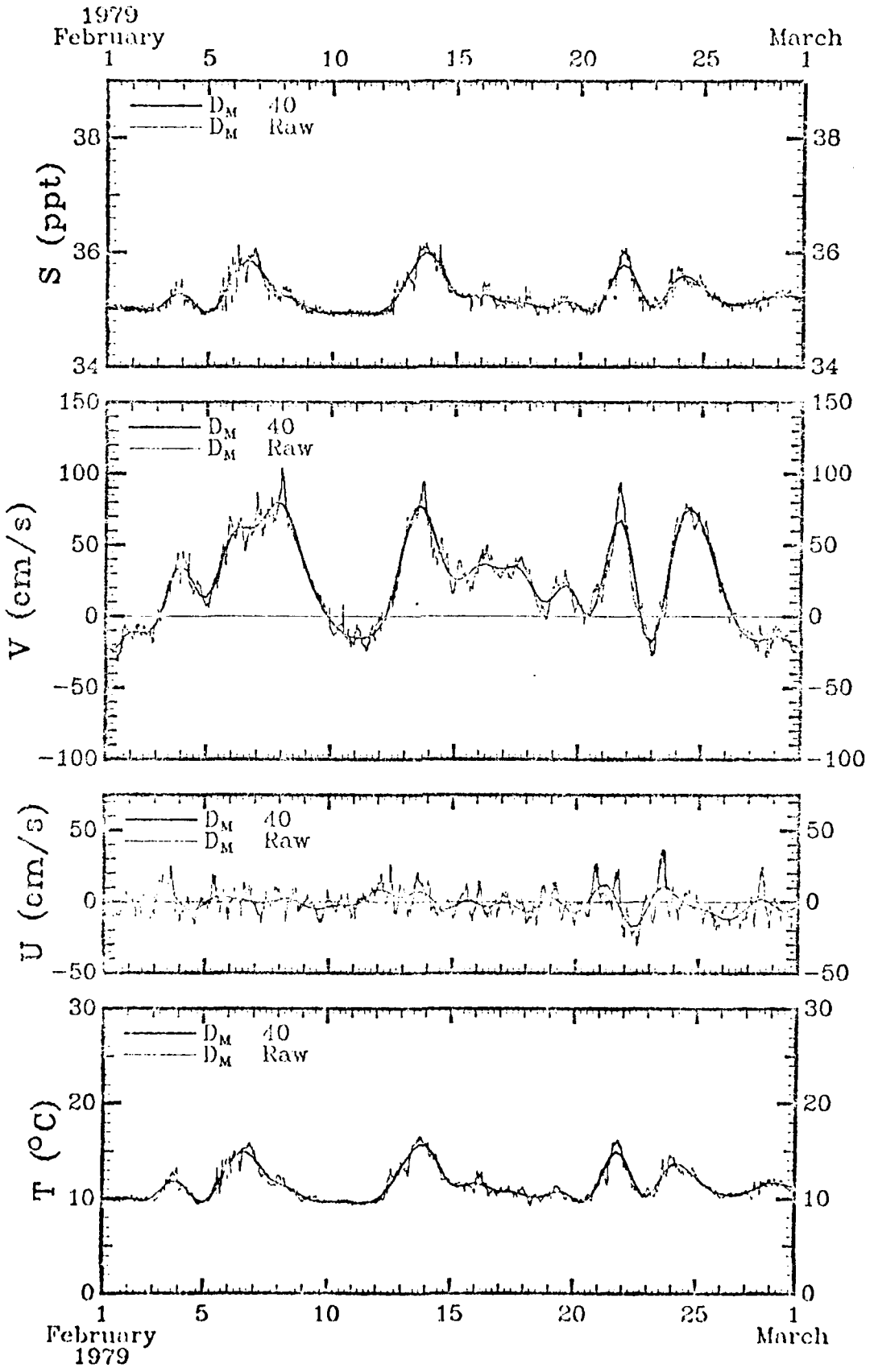

1979
February
March
1
5
10
15
20
25
1
D_T 40
D_T Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
February
1979
March
Date/Time

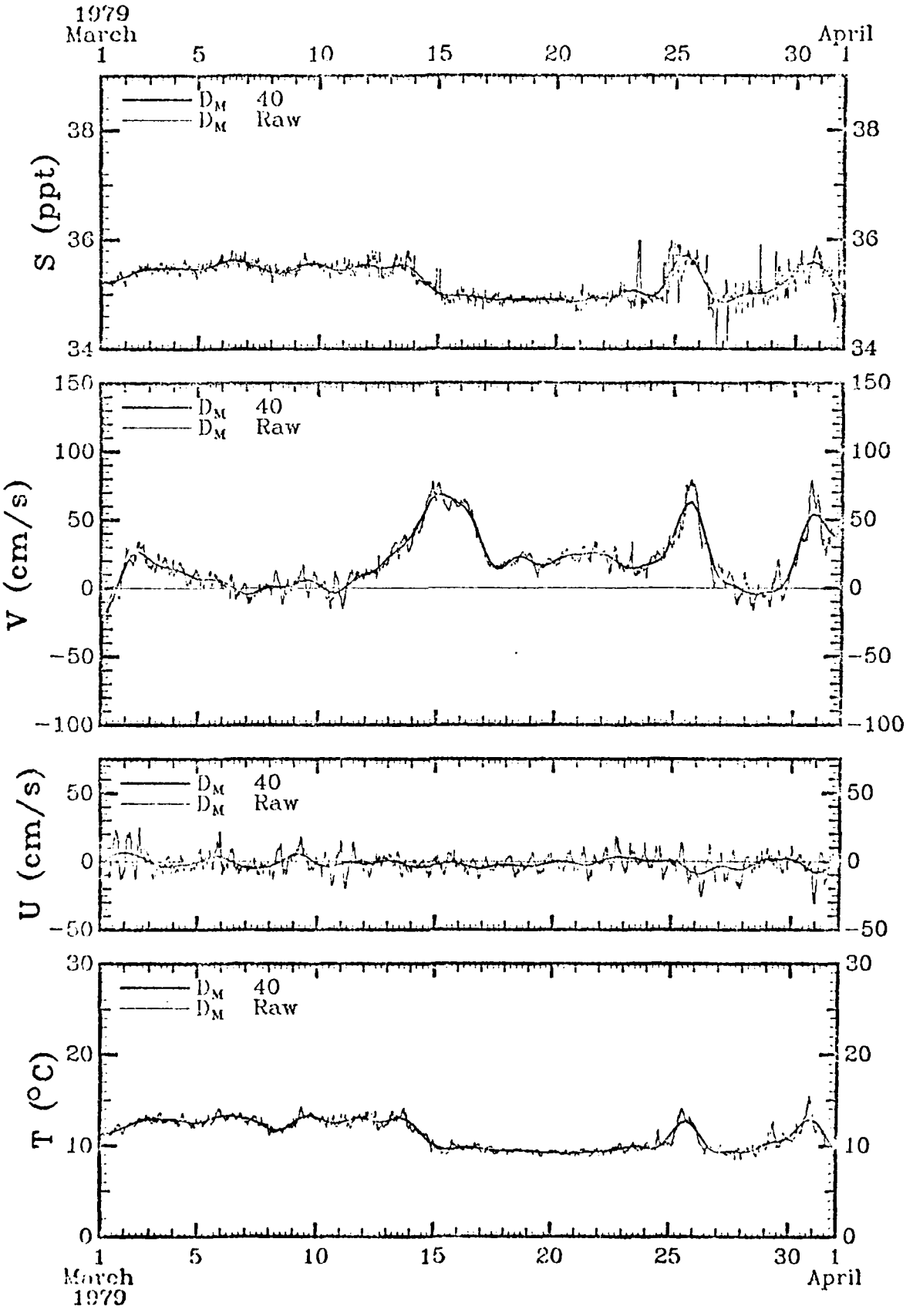

1979
March
April
1
5
10
15
20
25
30
1
D_T 40
D_T Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
April
Date/Time

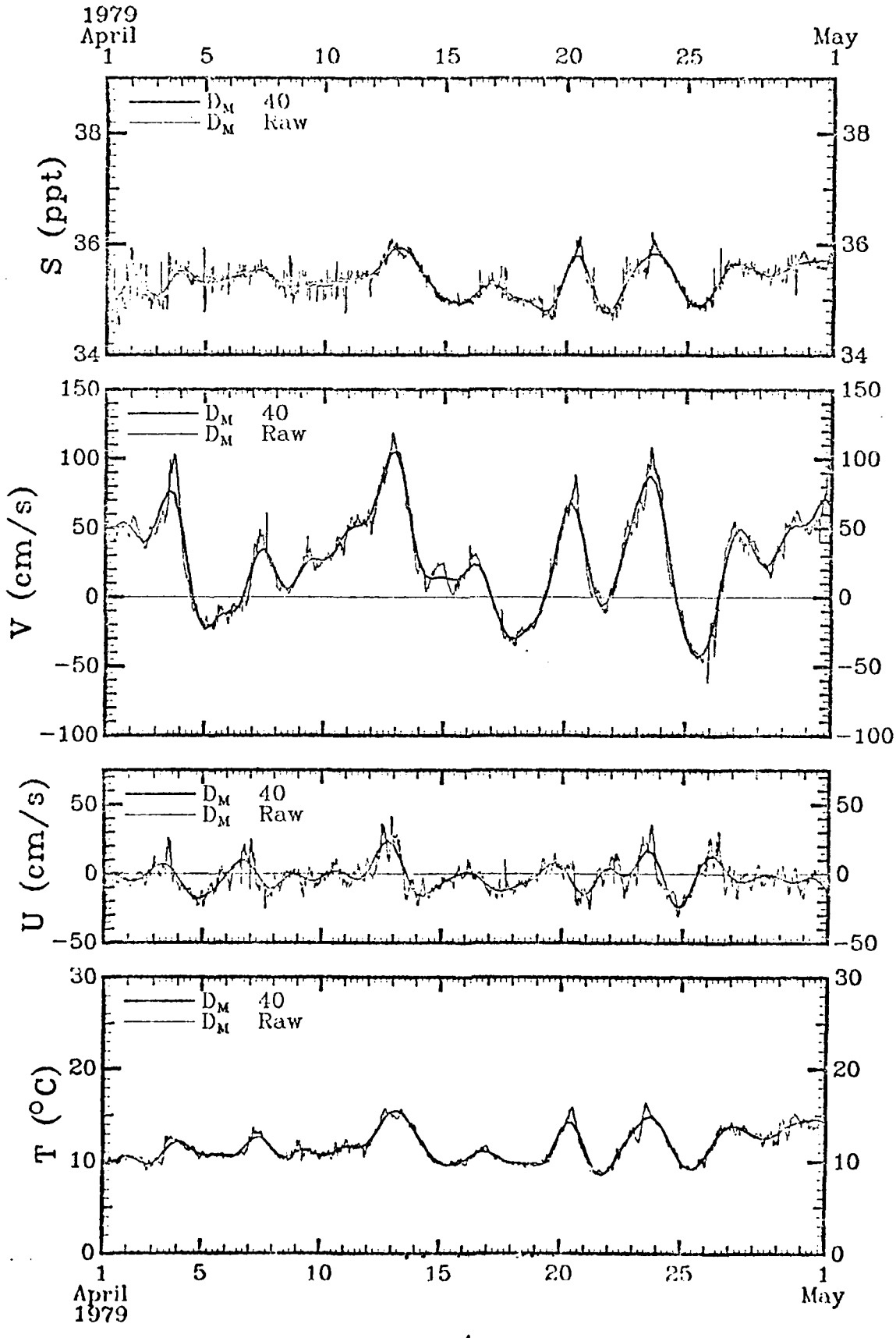

1979
April
May
1
5
10
15
20
25
D_T 40
D_T Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
Date/Time


1979
May
June
1
5
10
15
20
25
30
1
D_T 40
D_T Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
May
1979
June
Date/Time

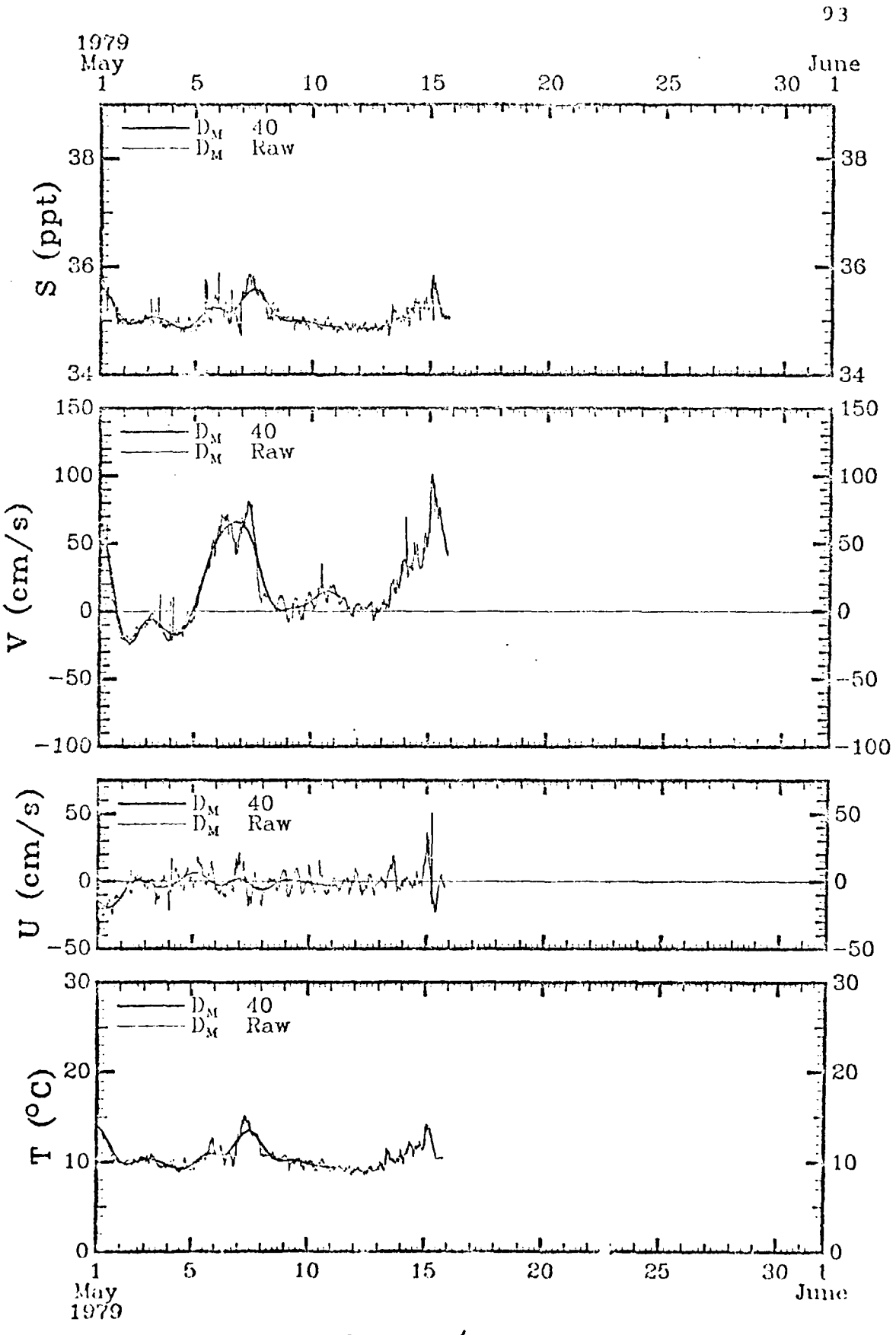

1979
January
February
1
5
10
15
20
25
30
1
D_M 40
D_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time

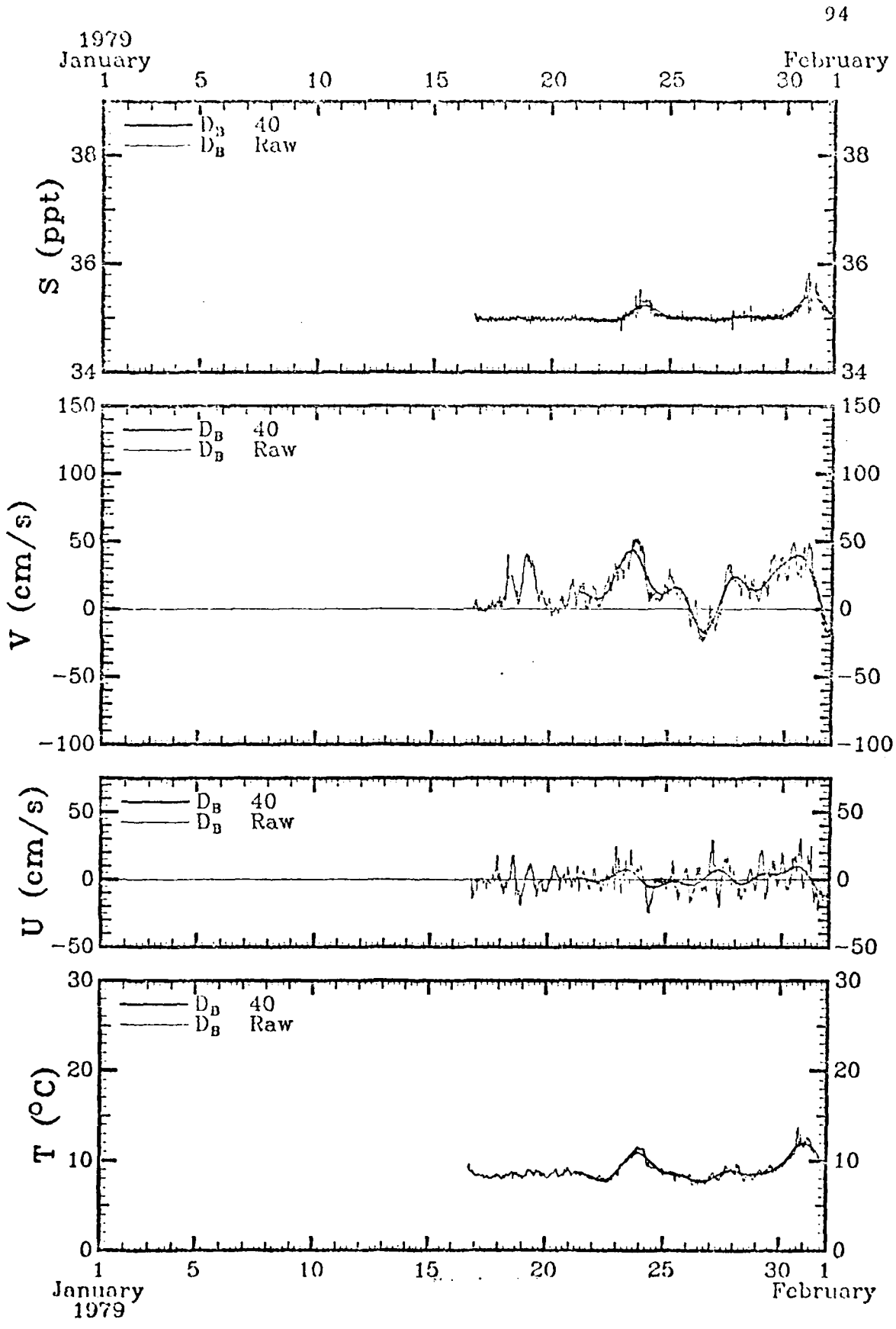

1979
February
March
1
5
10
15
20
25
1
D_M 40
D_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
February
1979
March
Date/Time

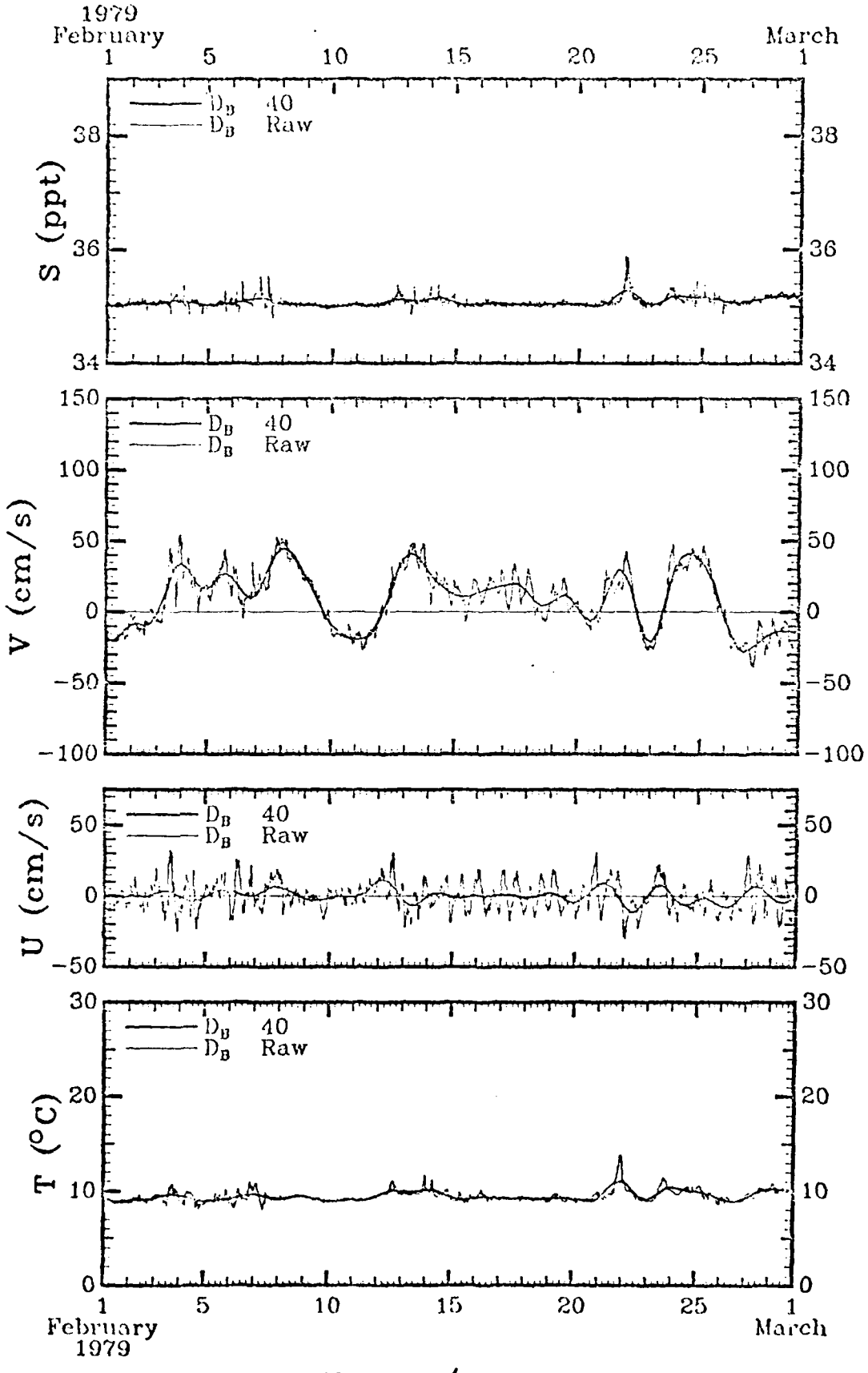

1979
March
April
1 5 10 15 20 25 30 1
D_M 40
D_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
April
Date/Time

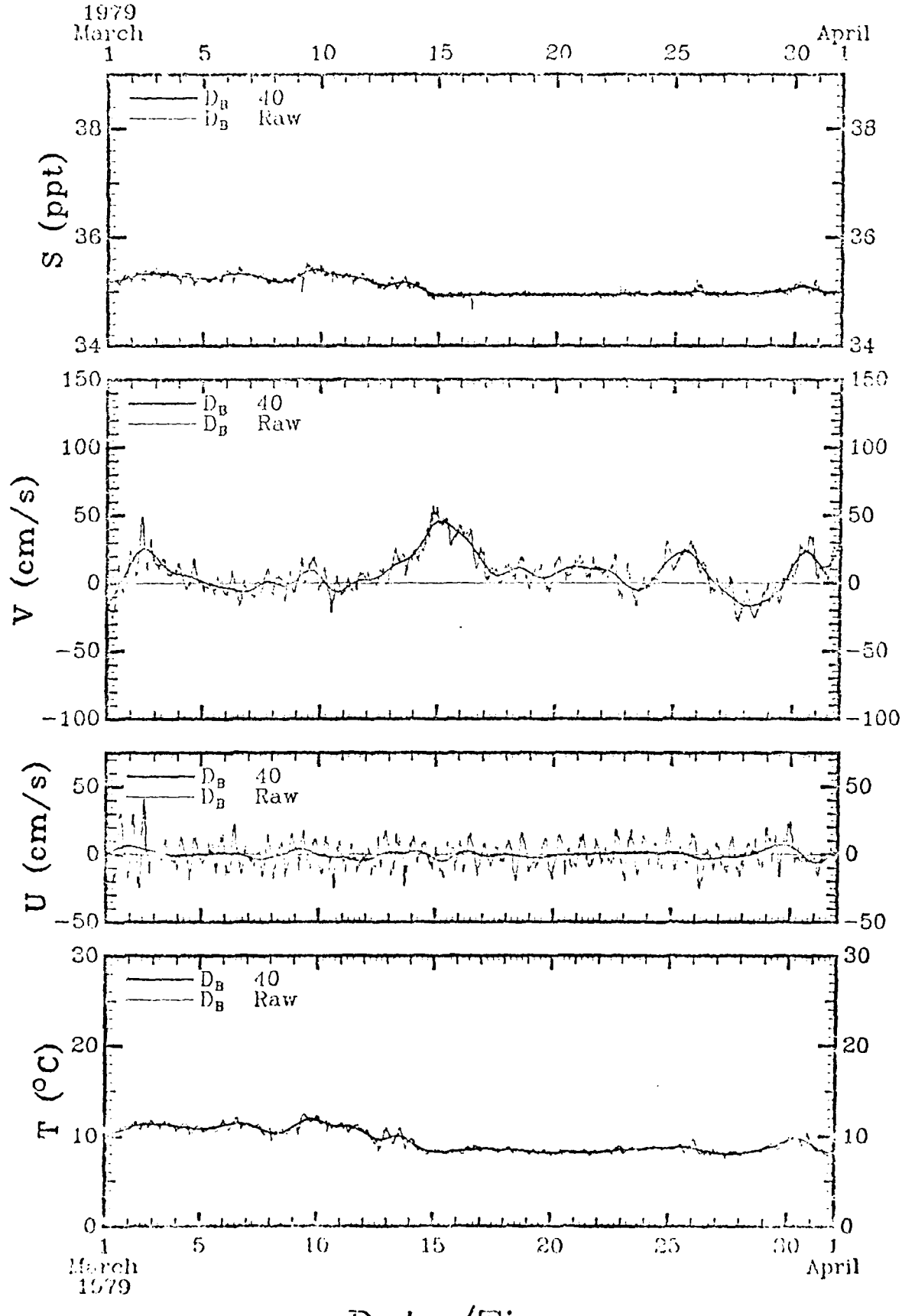

1979
April
1
5
10
15
20
25
May
1
D_M 40
D_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
April
1979

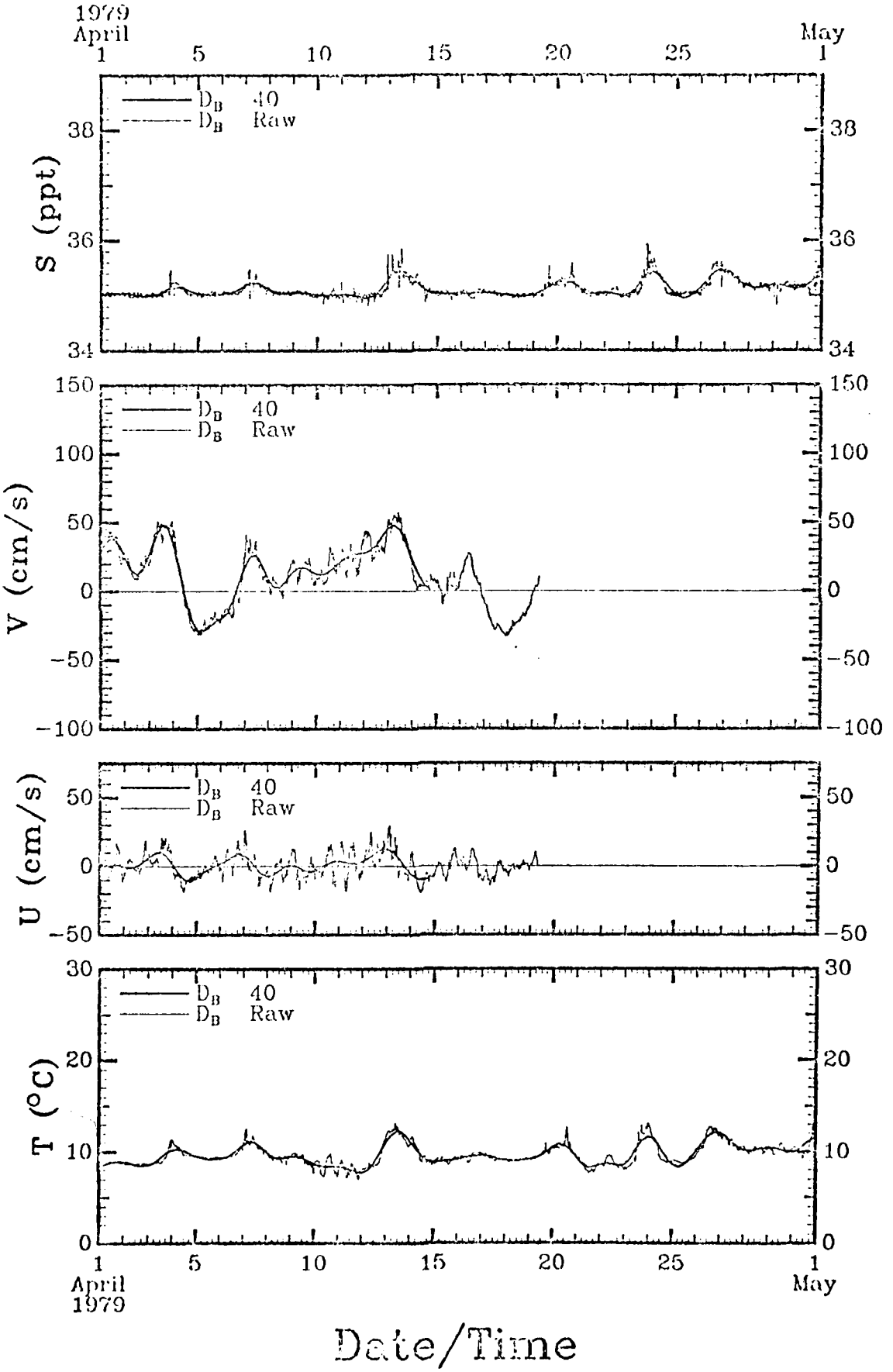
Date/Time

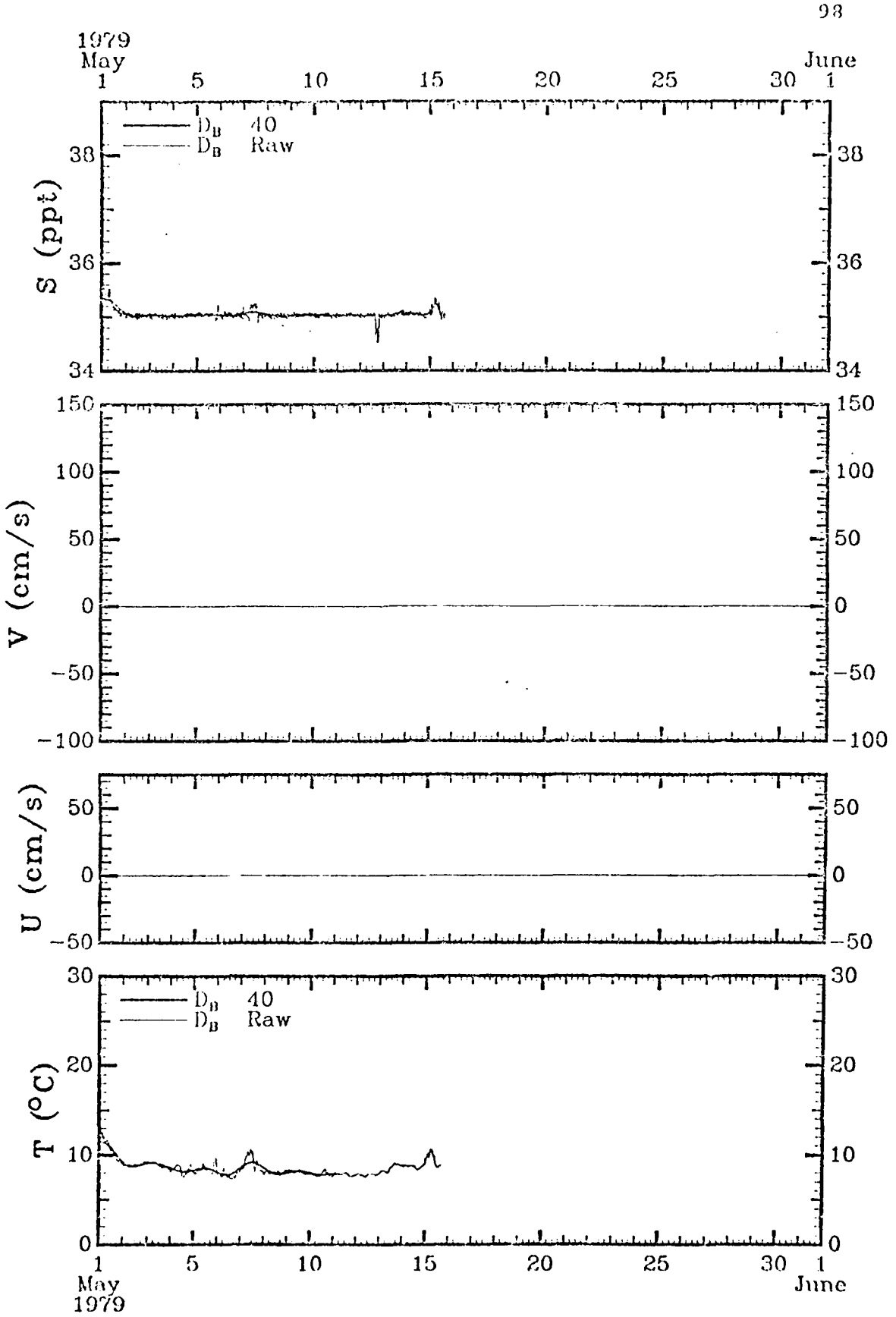

1979
May
June
1
5
10
15
20
25
30
1
D_M 40
D_M Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
May
1979
June
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
D_B 40
D_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
D_B 40
D_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
Date/Time


1979
March
April
1
5
10
15
20
25
30
1
D_B 40
D_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
Date/Time

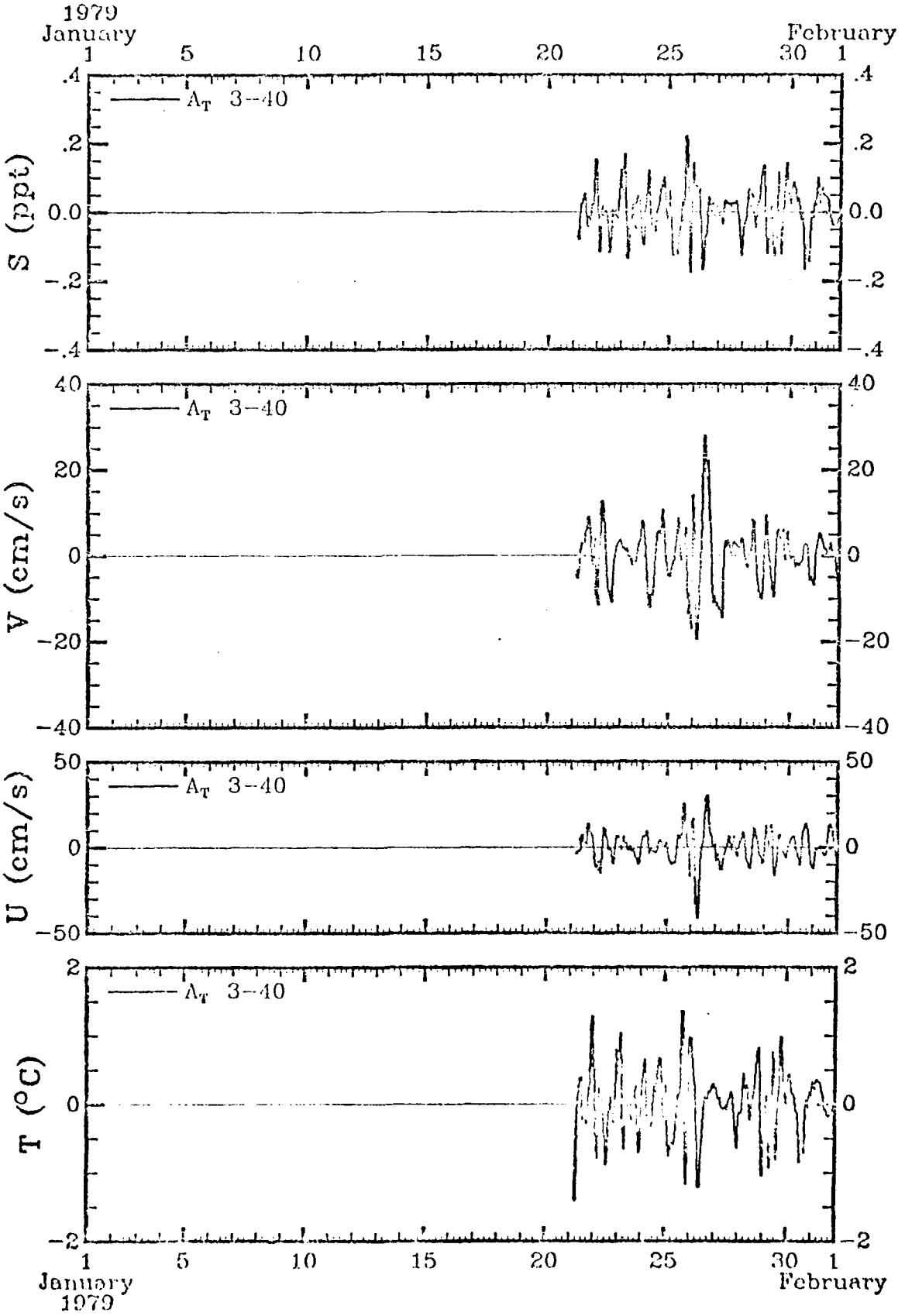

1979
April
May
1
5
10
15
20
25
1
D_B 40
D_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
April
1979
Date/Time

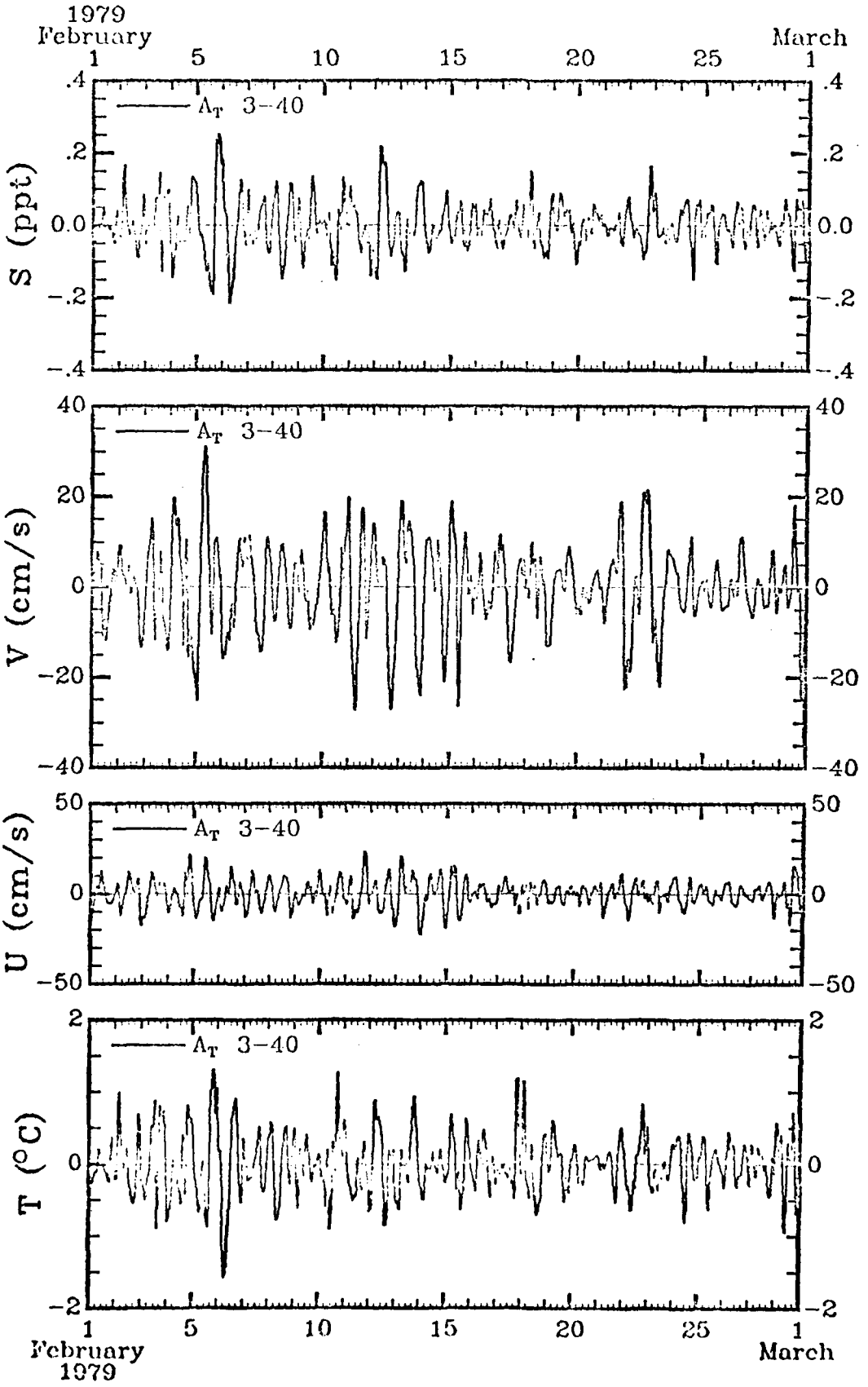

1979
May
June
1
5
10
15
20
25
30
1
D_B 40
D_B Raw
S (ppt)
38
36
34
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
May
1979
June
Date/Time

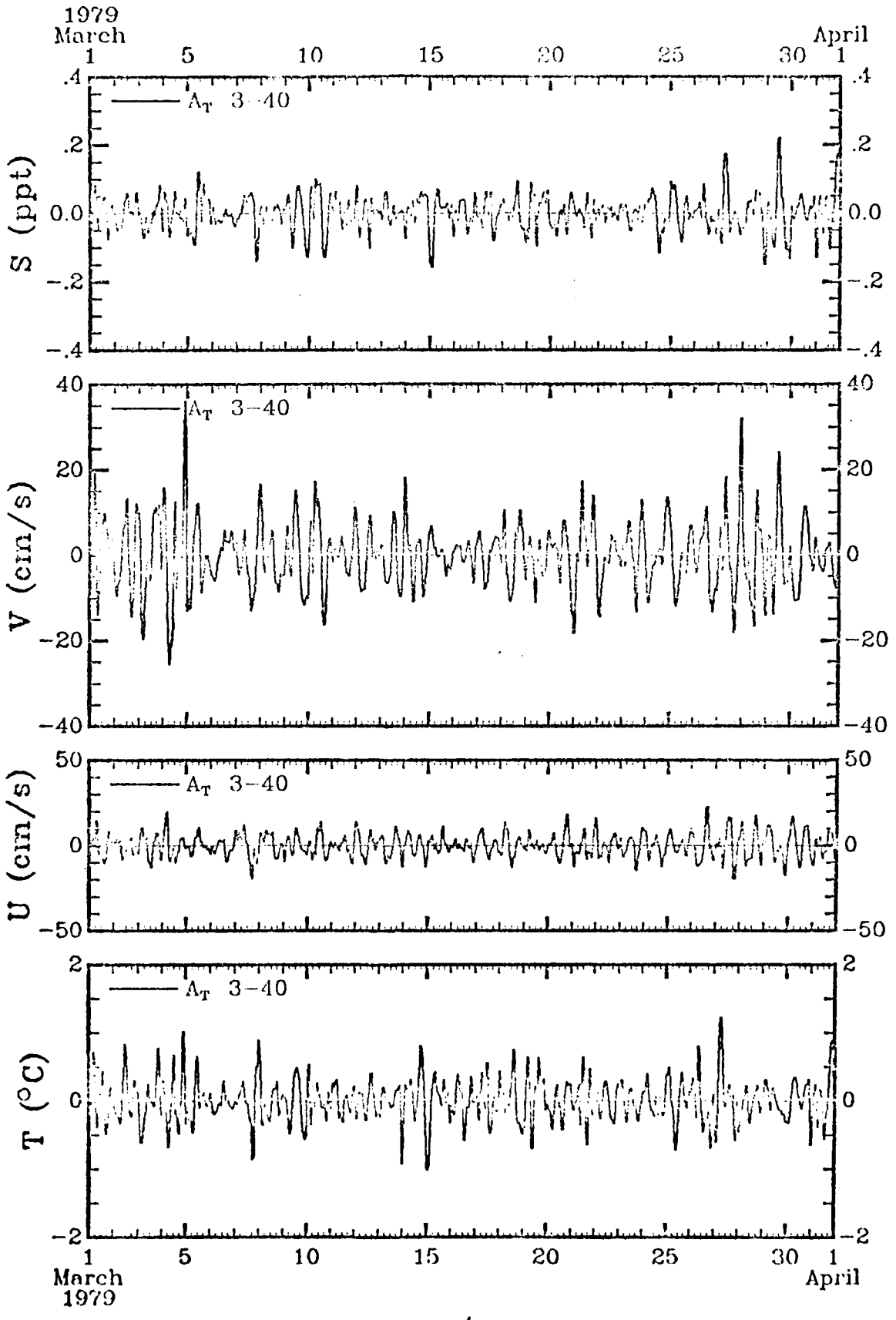
SECTION 4

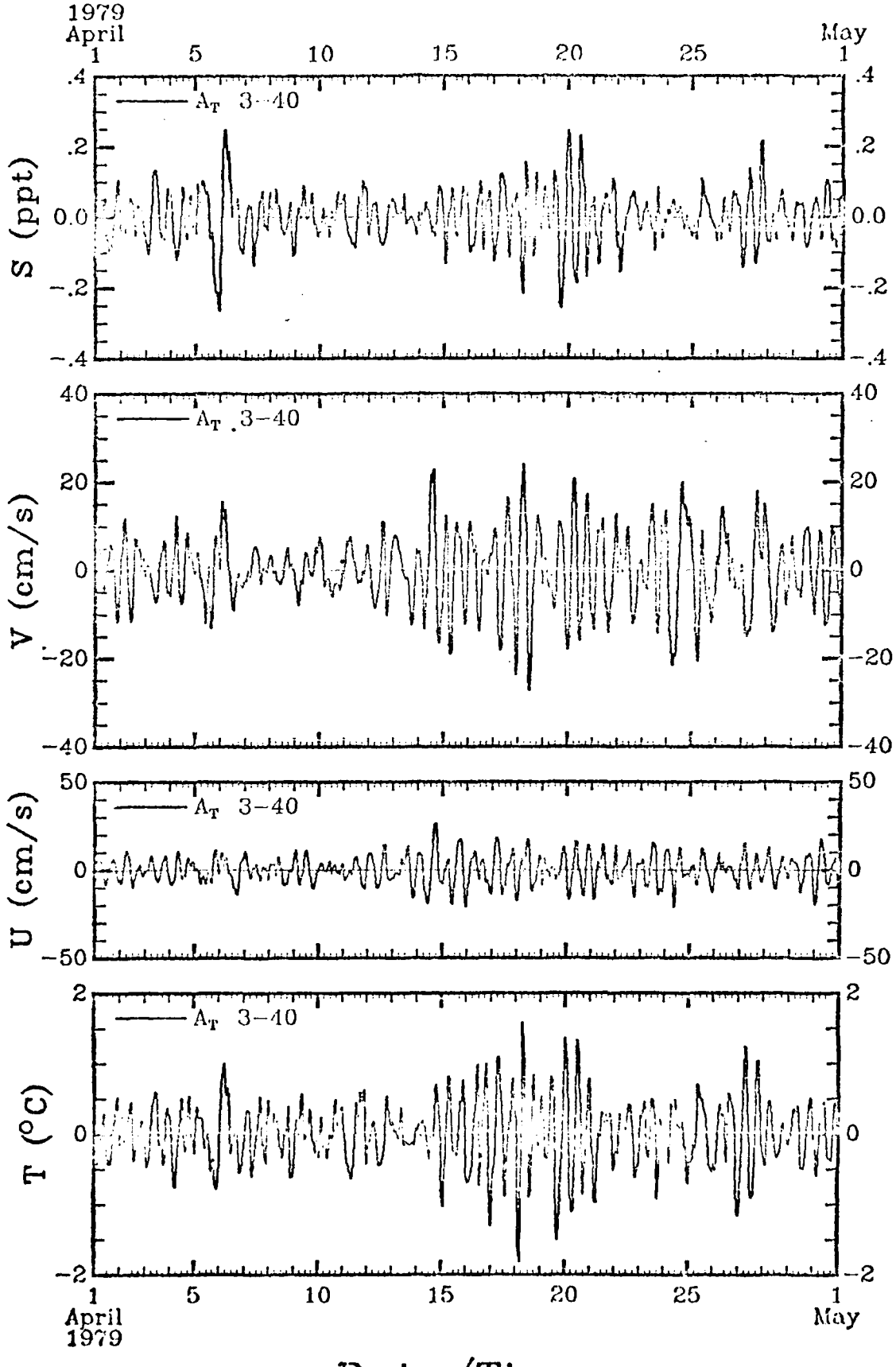
3–40 HRBP Data for Each Instrument

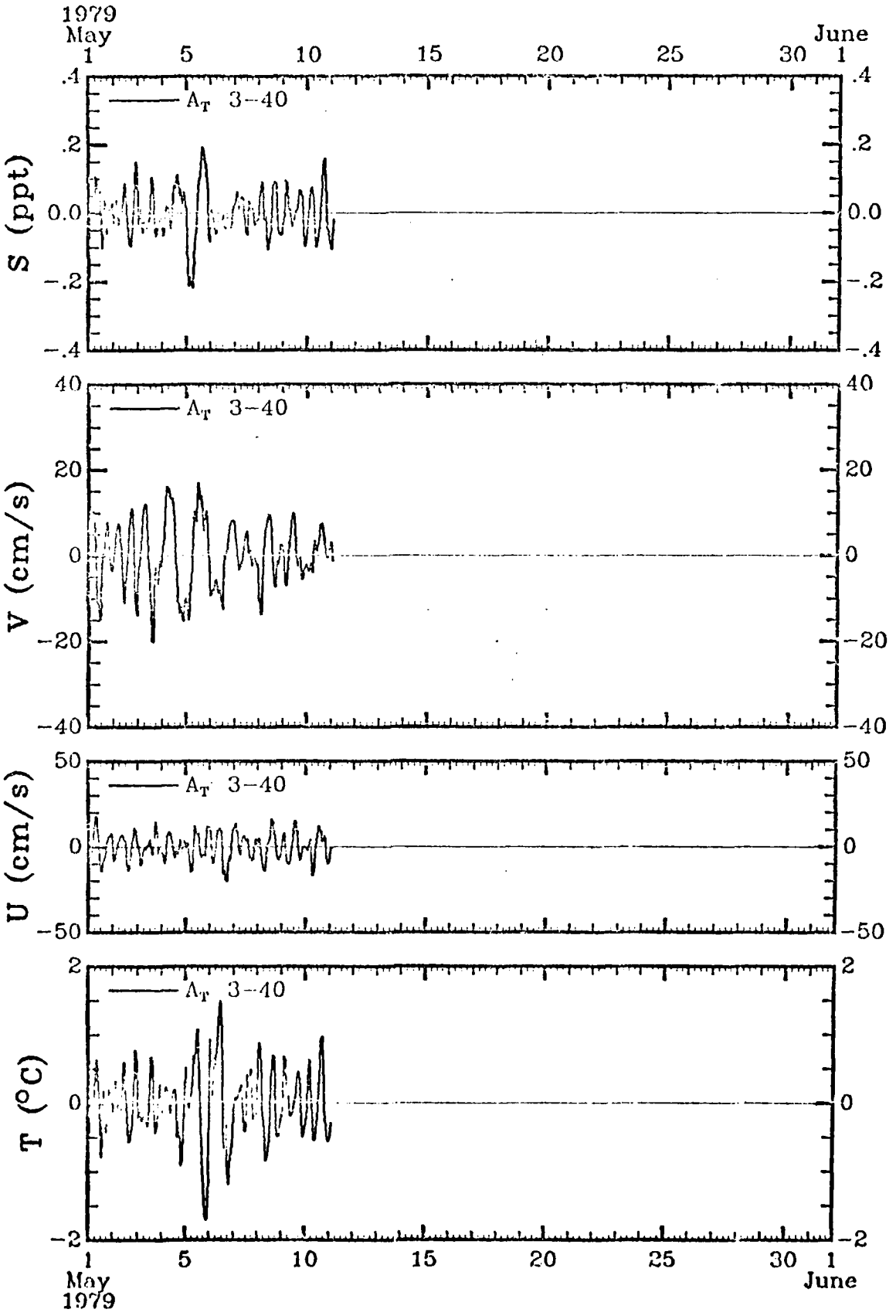
Figures 30 through 39 show the 3–40 HRBP current meter data separately by month for each instrument. The scale factors for similar data are not the same for all instruments in this section. Note that the bandpass operation removes the mean value.

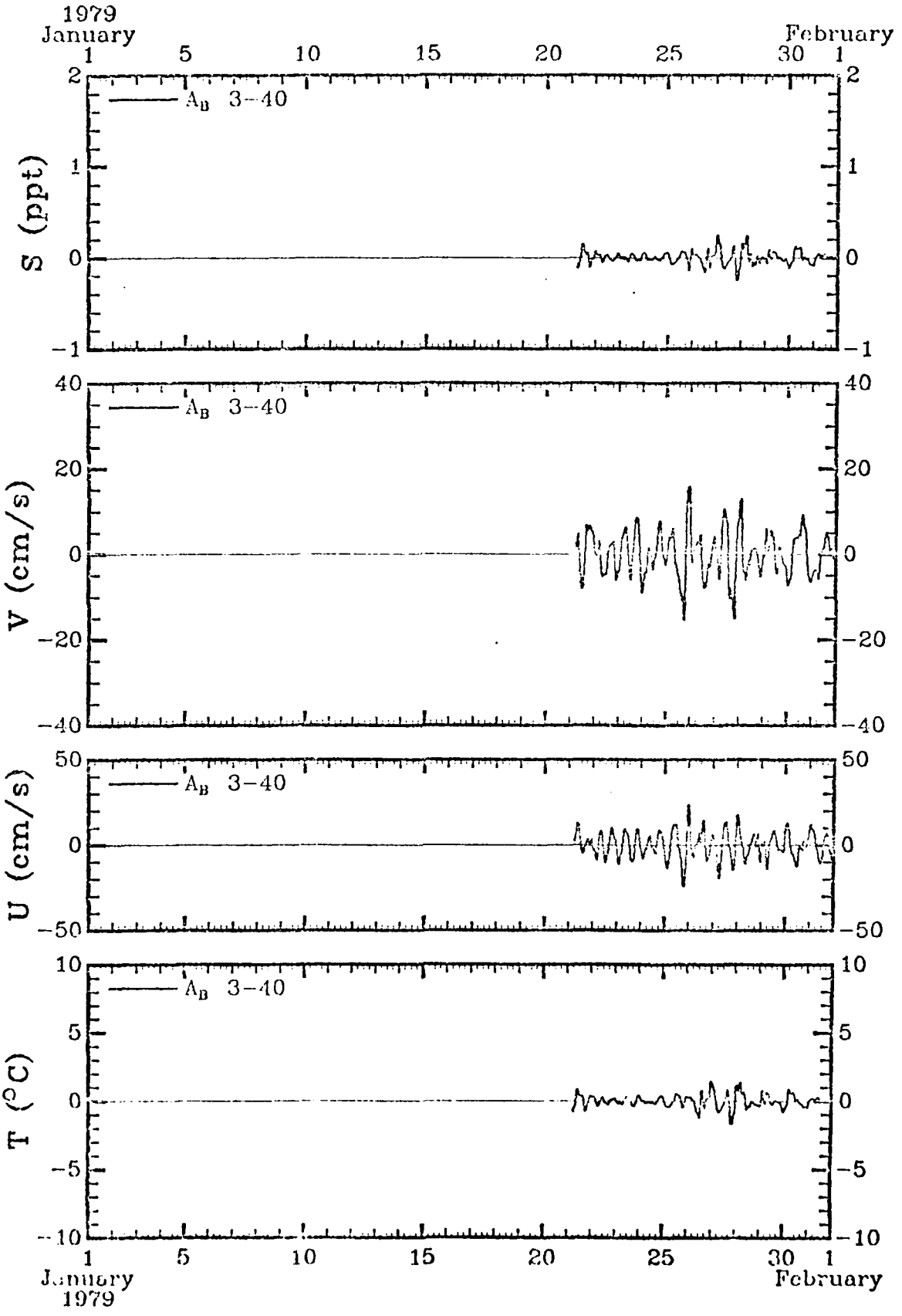

1979
January
February
1 5 10 15 20 25 30 1
A_T 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
.4
.2
0.0
−.2
−.4
40
20
0
−20
−40
50
0
−50
2
0
−2
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

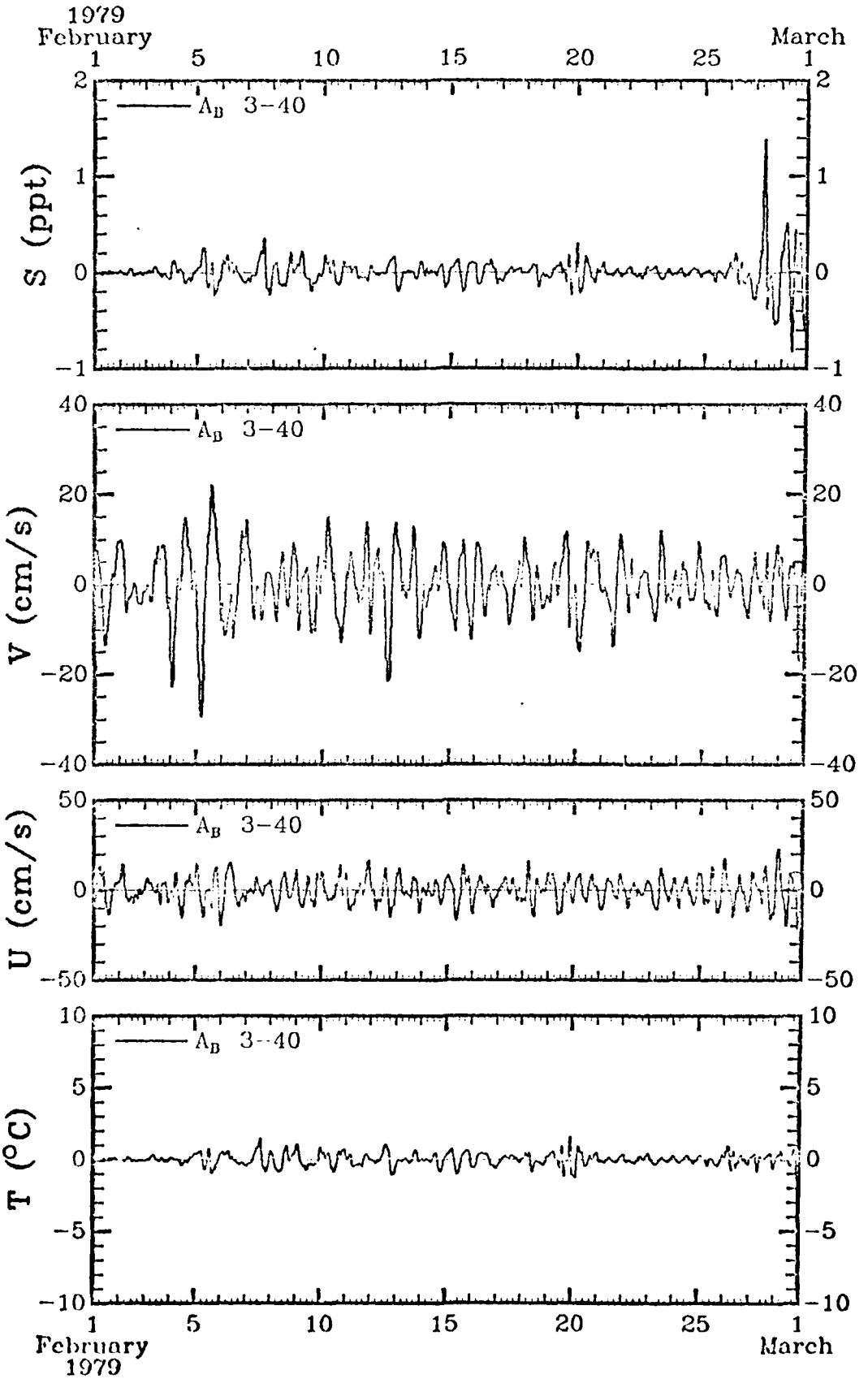

1979
February
March
1
5
10
15
20
25
1
A_T 3–40
S (ppt)
.4
.2
0.0
-.2
-.4
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
2
0
-2
February
1979
March
Date/Time

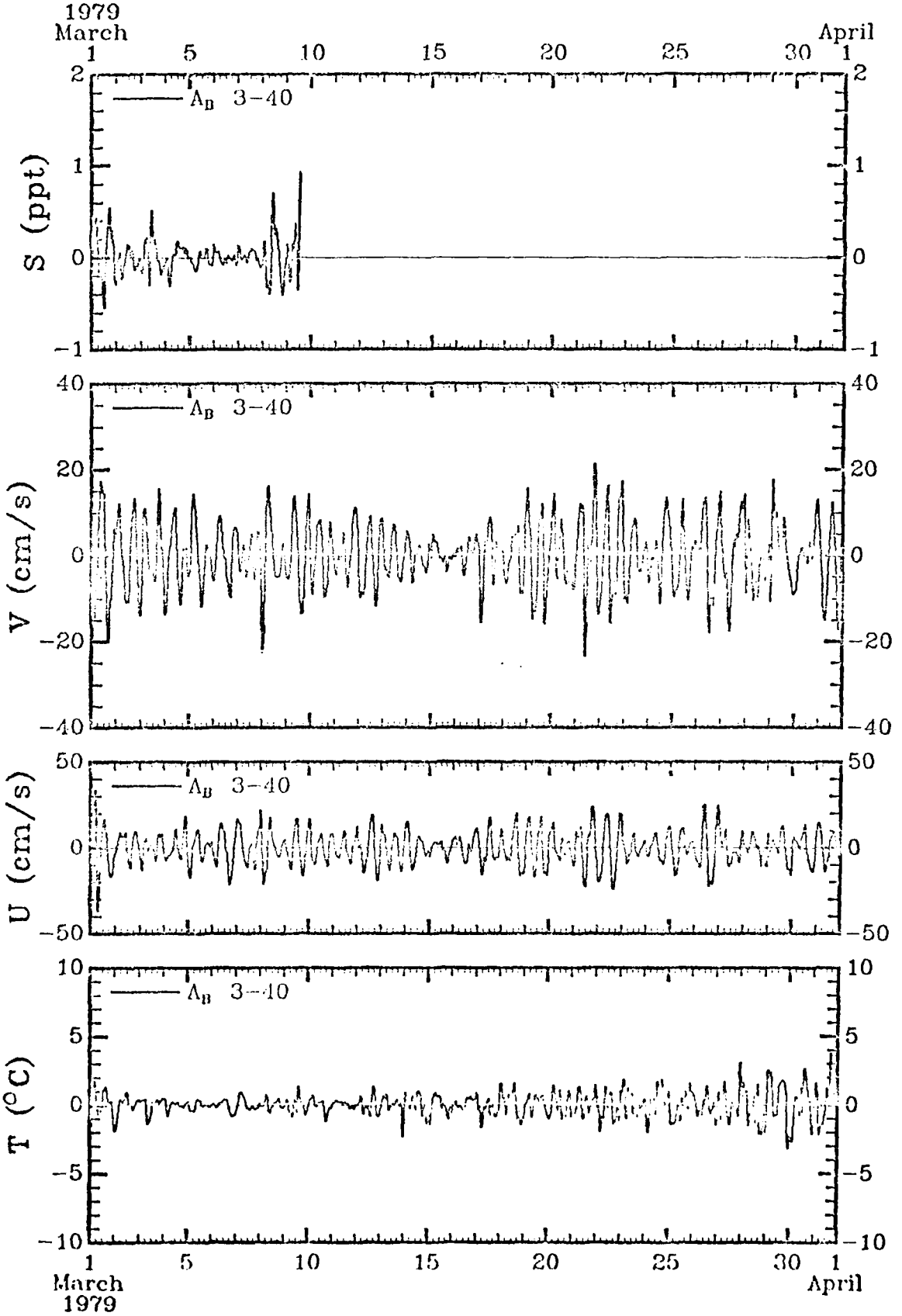

1979
March
April
1 5 10 15 20 25 30 1
A_T 3-40
S (ppt)
.4 .2 0.0 -.2 -.4
V (cm/s)
40 20 0 -20 -40
U (cm/s)
50 0 -50
T (°C)
2 0 -2
1 5 10 15 20 25 30 1
March
1979
April
Date/Time

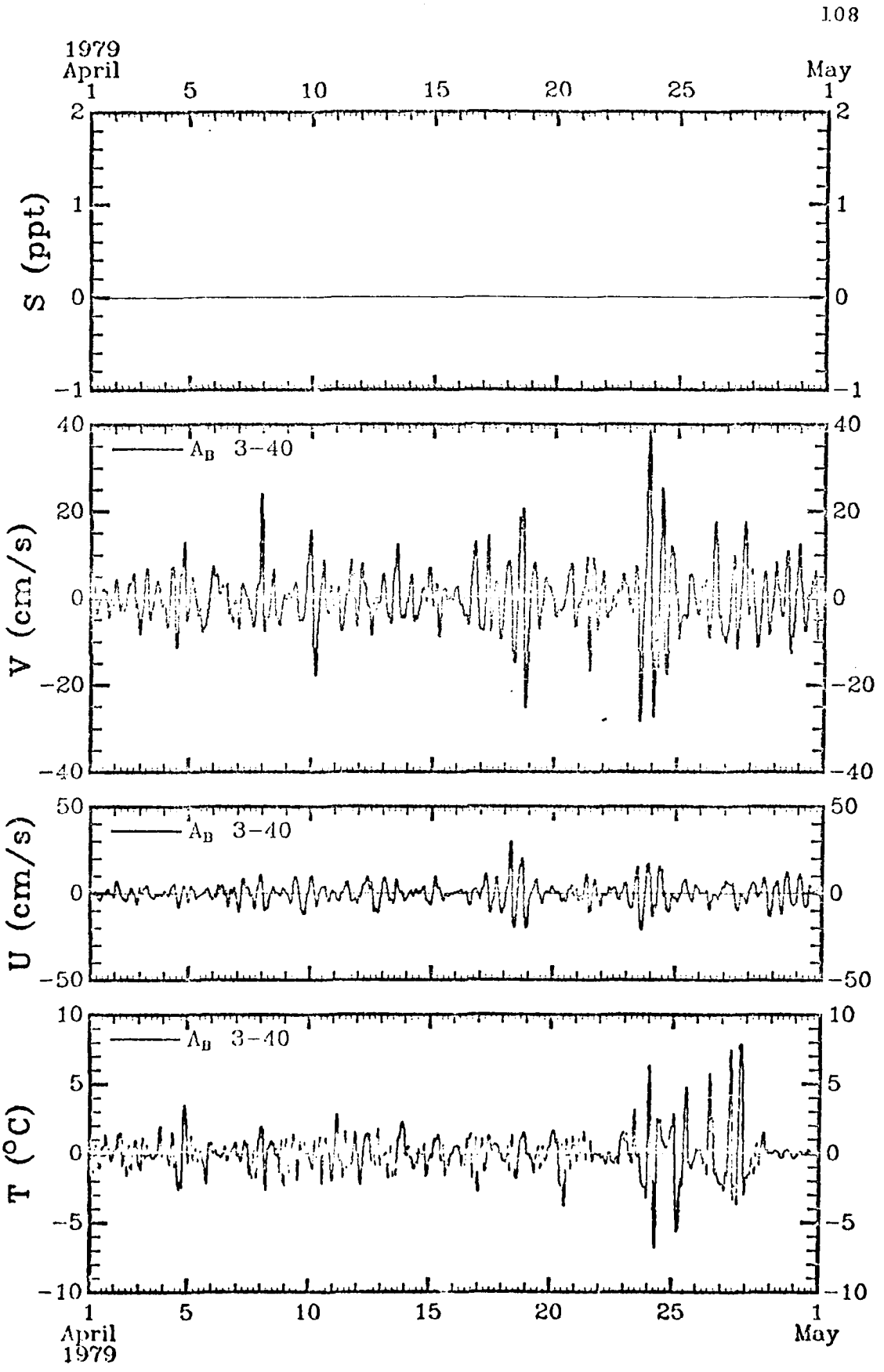

1979
April
May
1
5
10
15
20
25
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
A_T 3–40
Date/Time

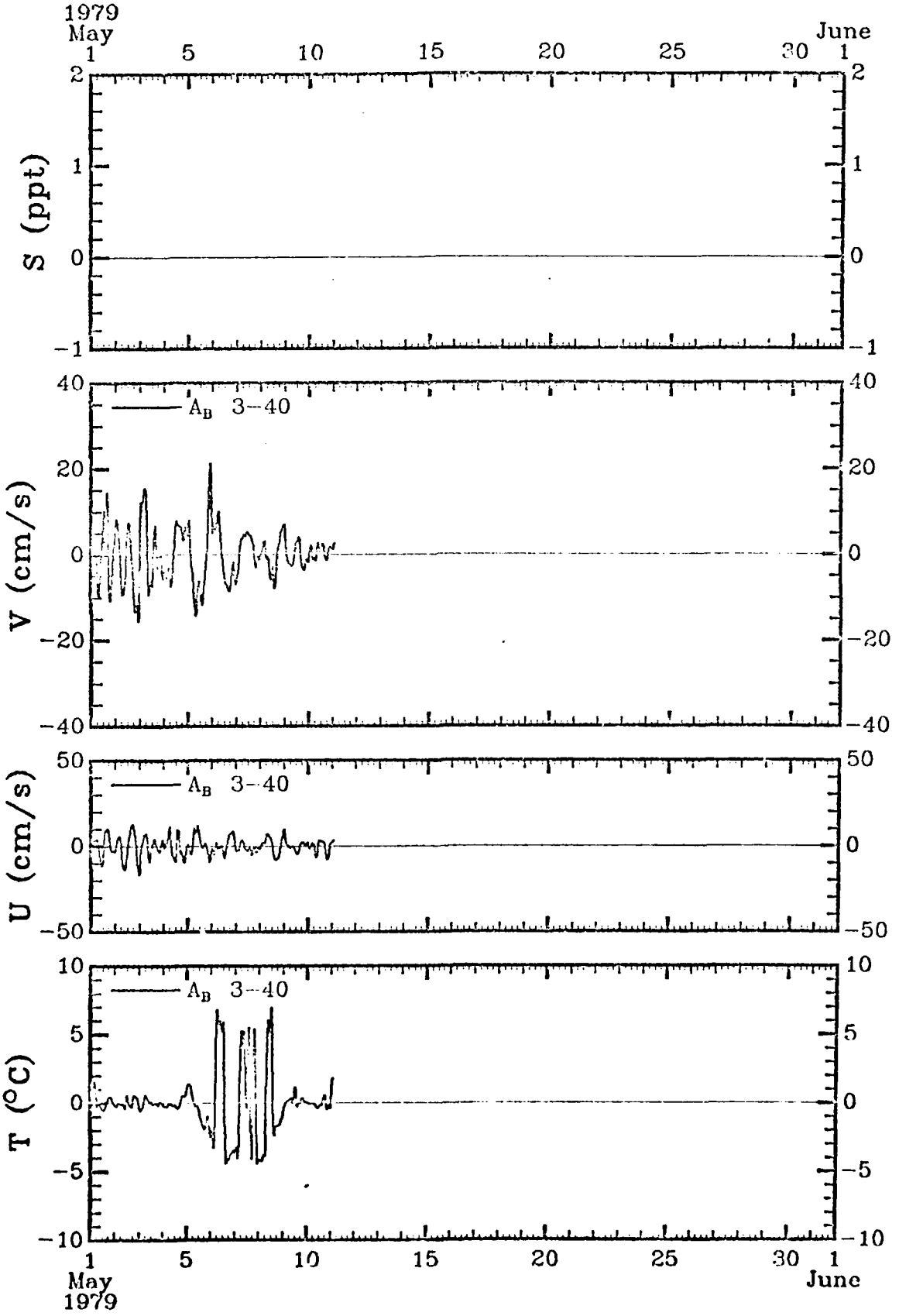

1979
May
June
1
5
10
15
20
25
30
1
A_T 3–40
S (ppt)
.4
.2
0.0
−.2
−.4
V (cm/s)
40
20
0
−20
−40
U (cm/s)
50
0
−50
T (°C)
2
0
−2
May
1979
June
Date/Time

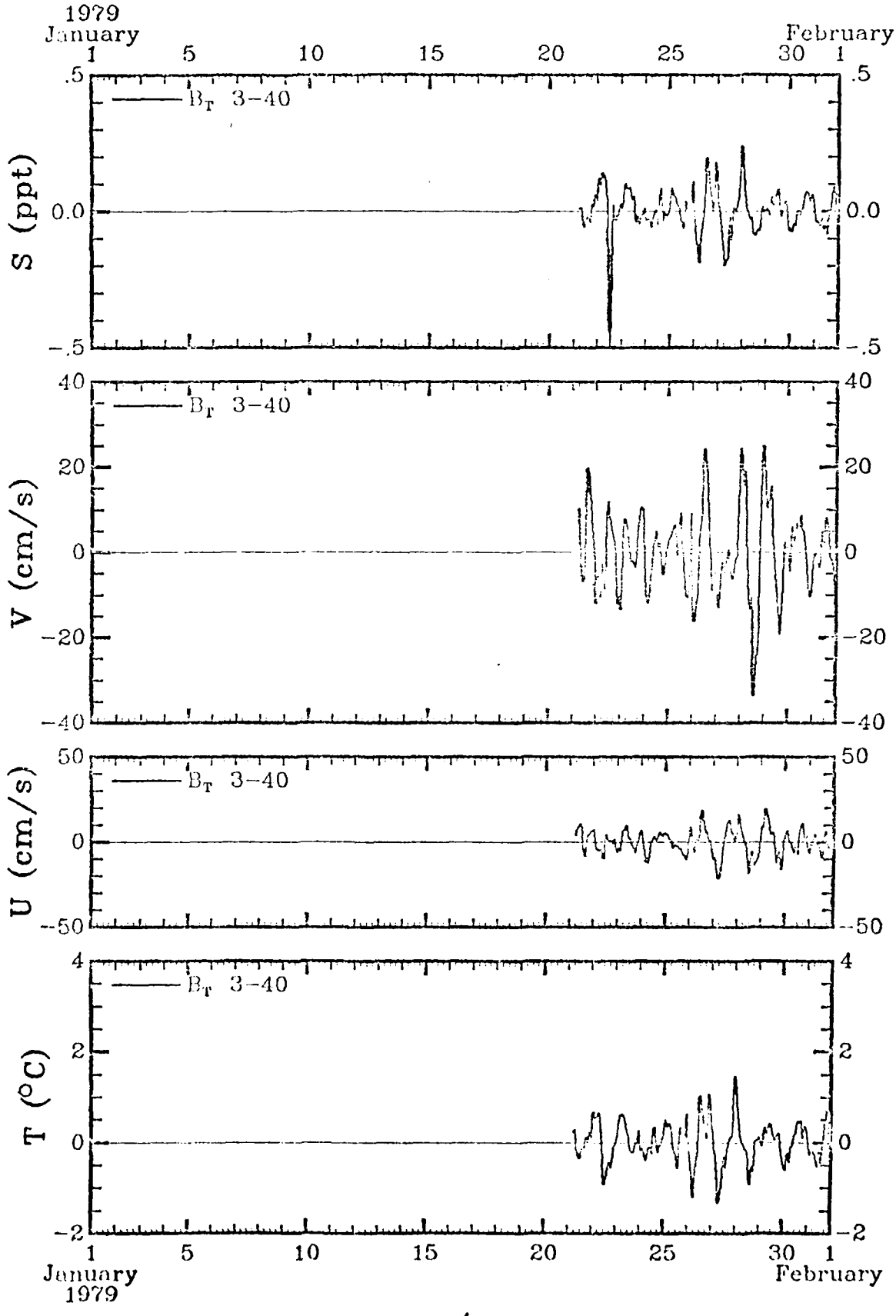

1979
January
February
1 5 10 15 20 25 30 1
A_B 3–40
S (ppt)
2 1 0 −1
V (cm/s)
40 20 0 −20 −40
U (cm/s)
50 0 −50
T (°C)
10 5 0 −5 −10
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

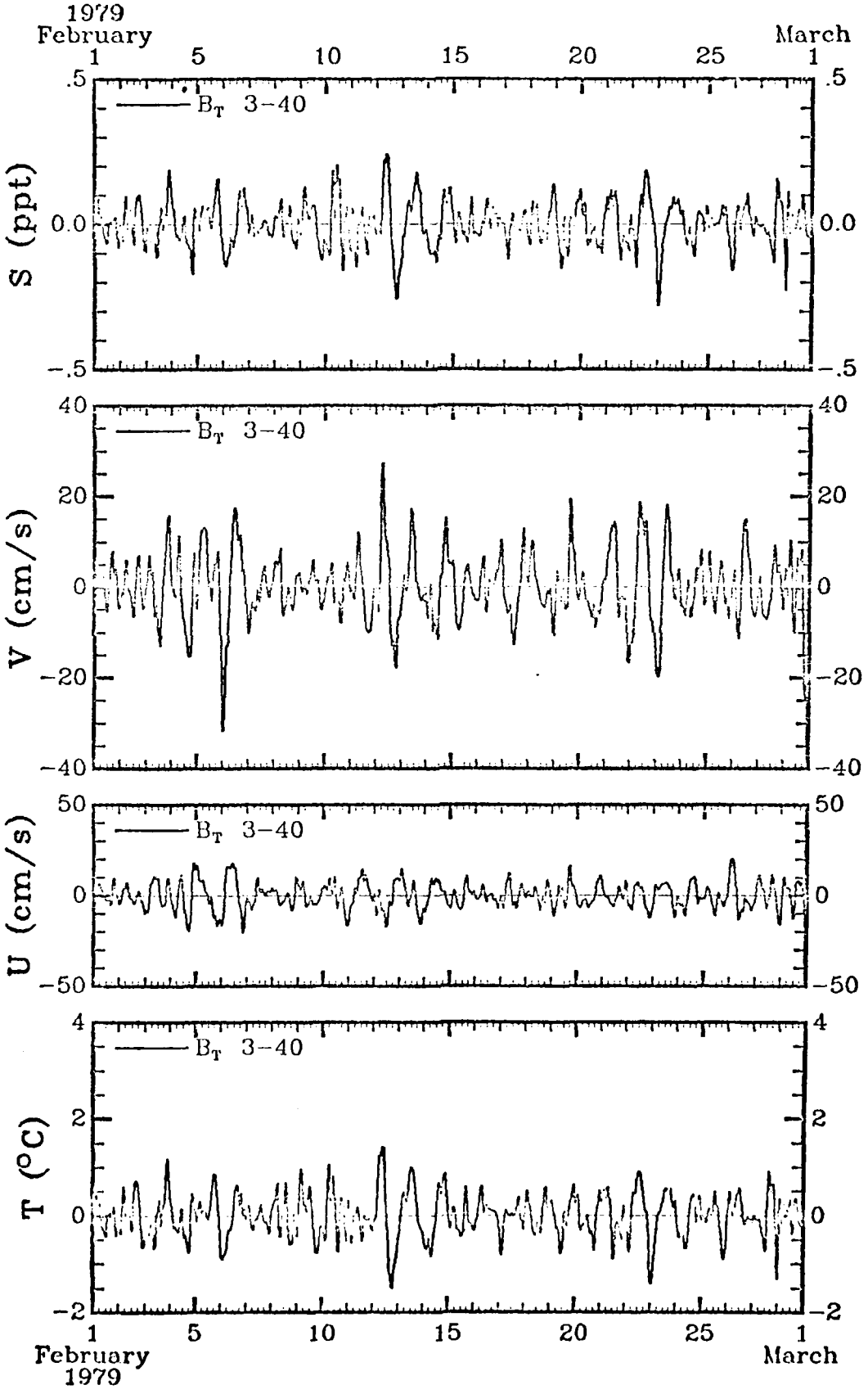

1979
February
March
1
5
10
15
20
25
1
A_B 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
Date/Time

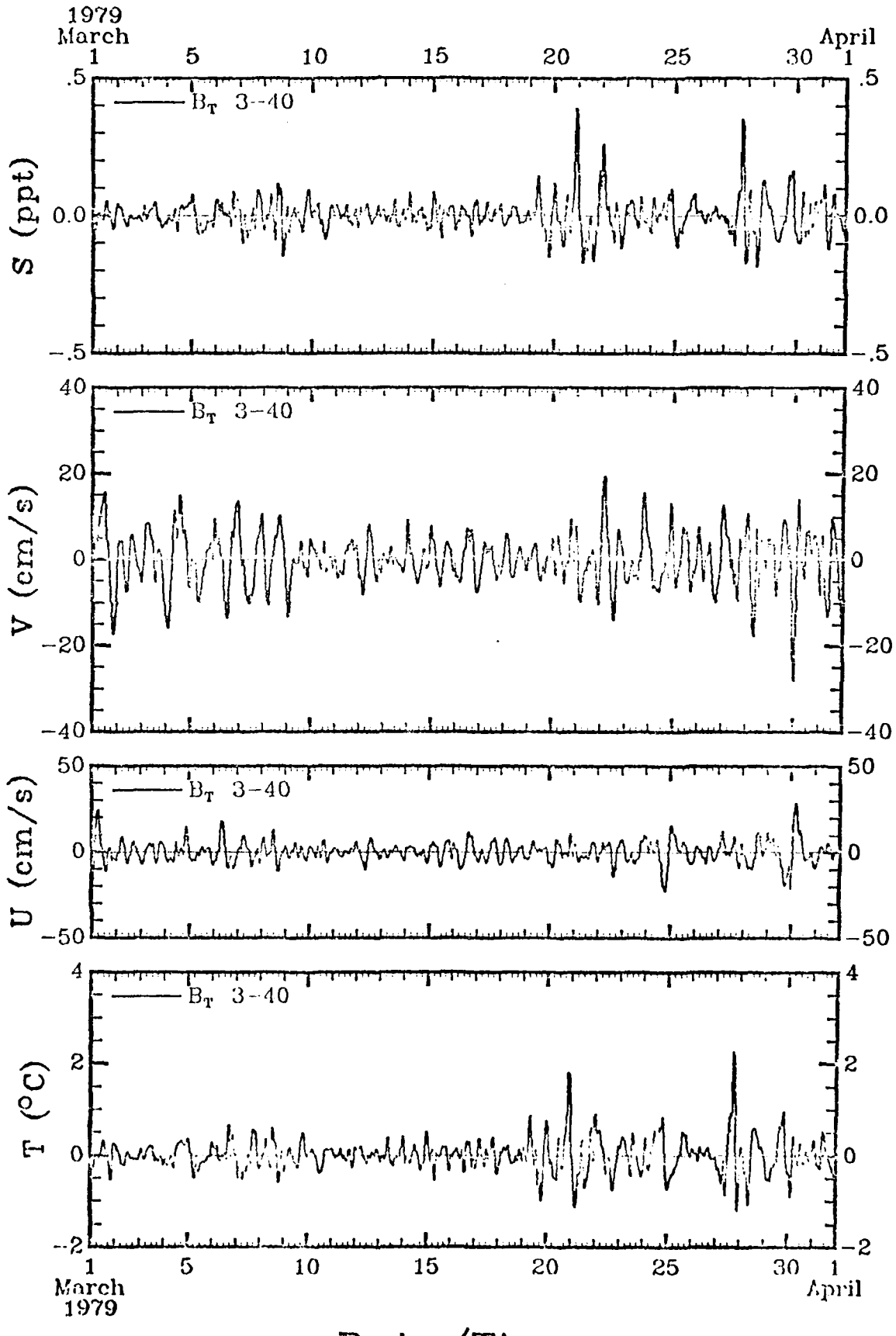

1979
March
April
1 5 10 15 20 25 30 1
Λ_B 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
2 1 0 −1
40 20 0 −20 −40
50 0 −50
10 5 0 −5 −10
March
1979
April
Date/Time

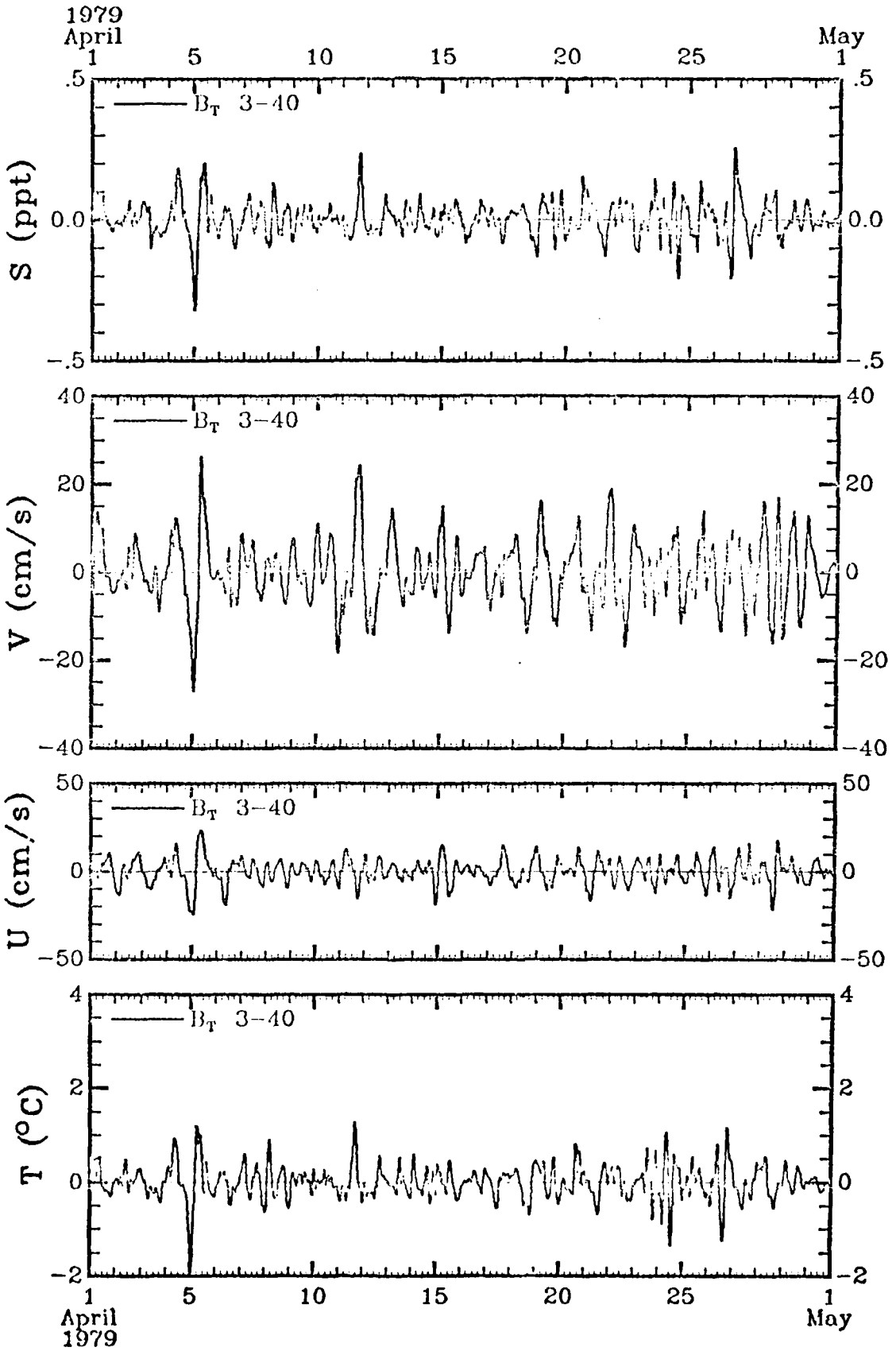

1979
April
May
1
5
10
15
20
25
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
A_B 3-40
Date/Time

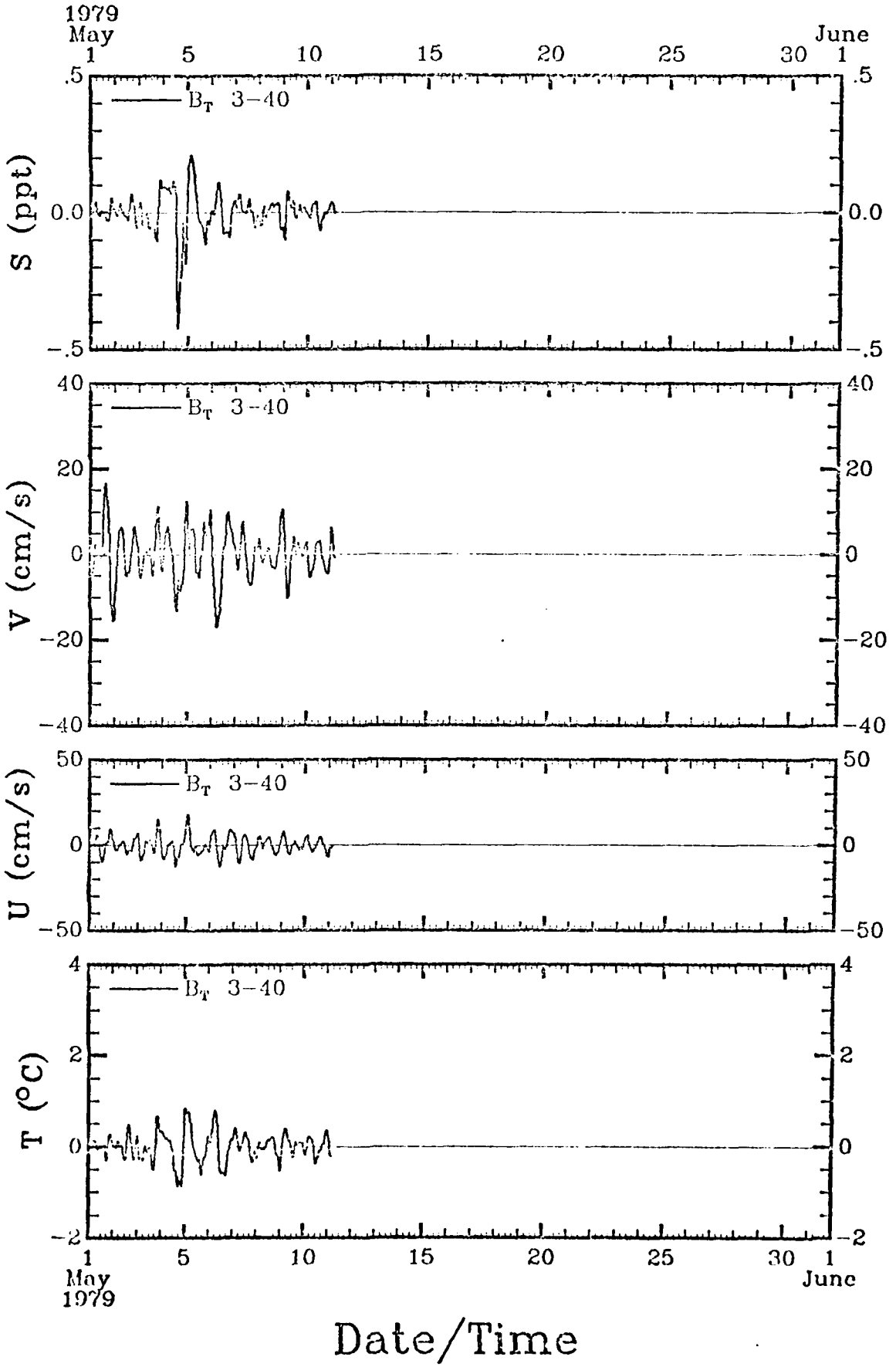

1979
May
June
1
5
10
15
20
25
30
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
A_B 3–40
Date/Time

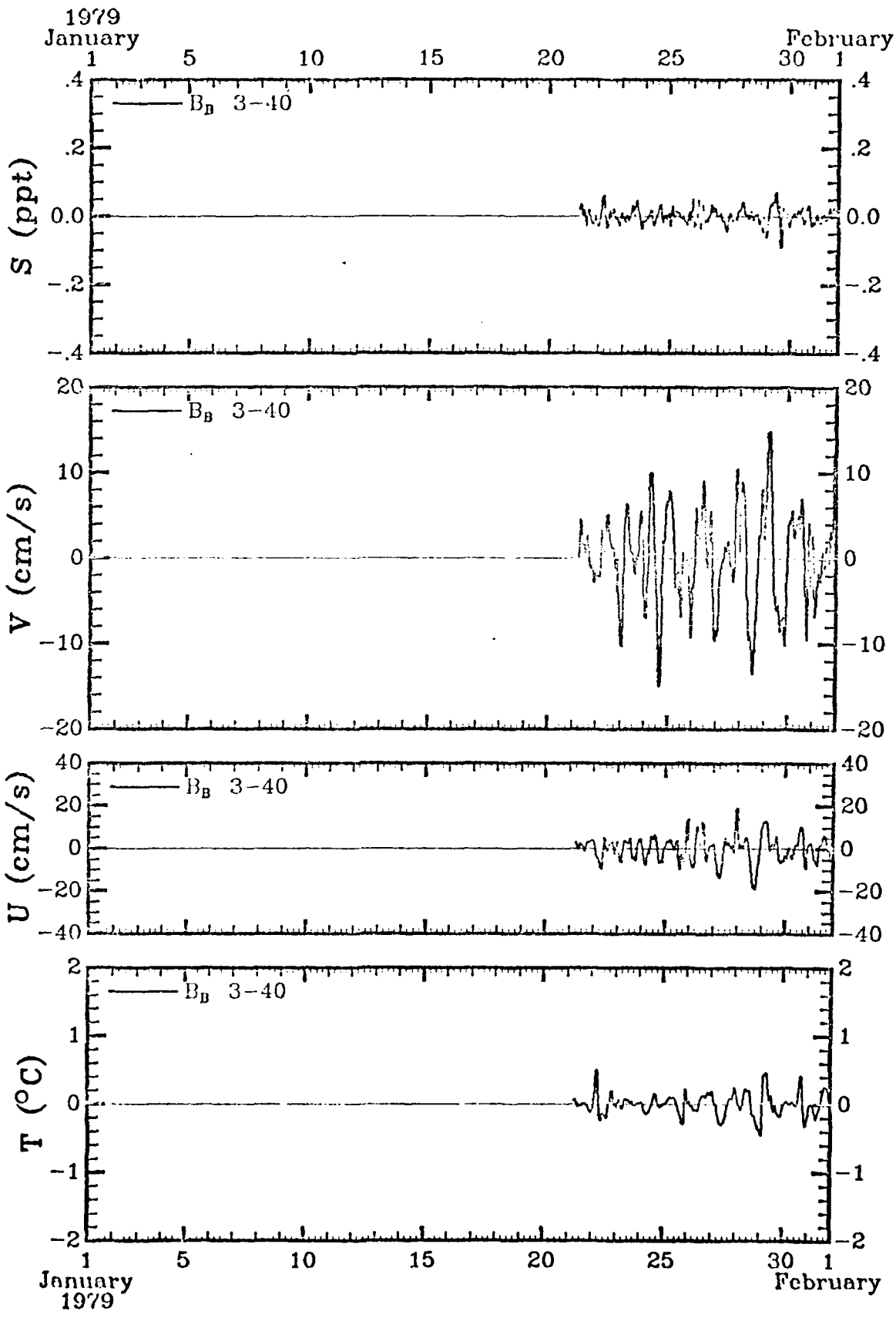

1979
January
February
1 5 10 15 20 25 30 1
B_T 3-40
S (ppt)
.5
0.0
-.5
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
4
2
0
-2
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

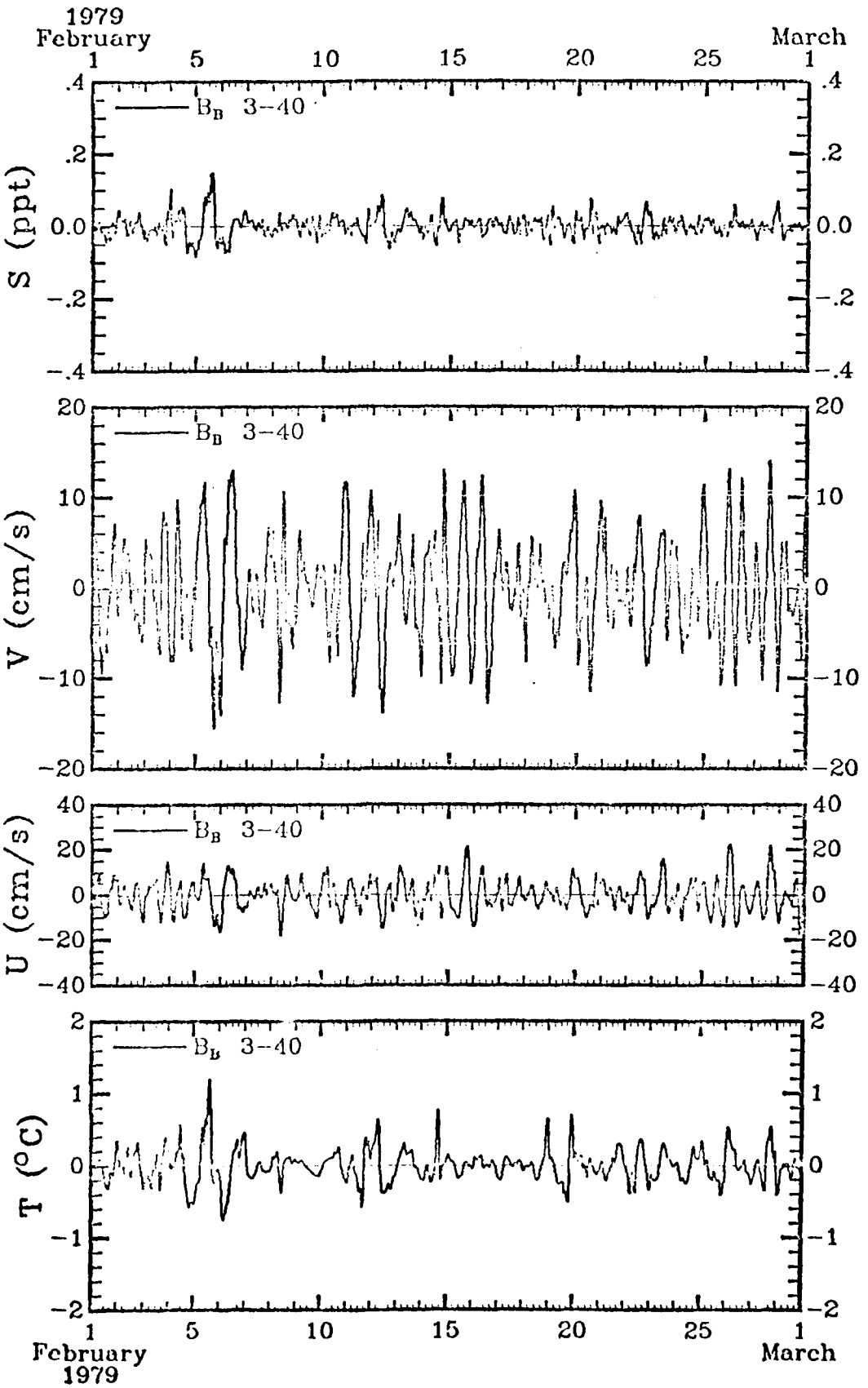

1979
February
March
1 5 10 15 20 25 1
.5
0.0
−.5
B_T 3–40
S (ppt)
40
20
0
−20
−40
V (cm/s)
50
0
−50
U (cm/s)
4
2
0
−2
T (°C)
1 5 10 15 20 25 1
February
1979
March
Date/Time

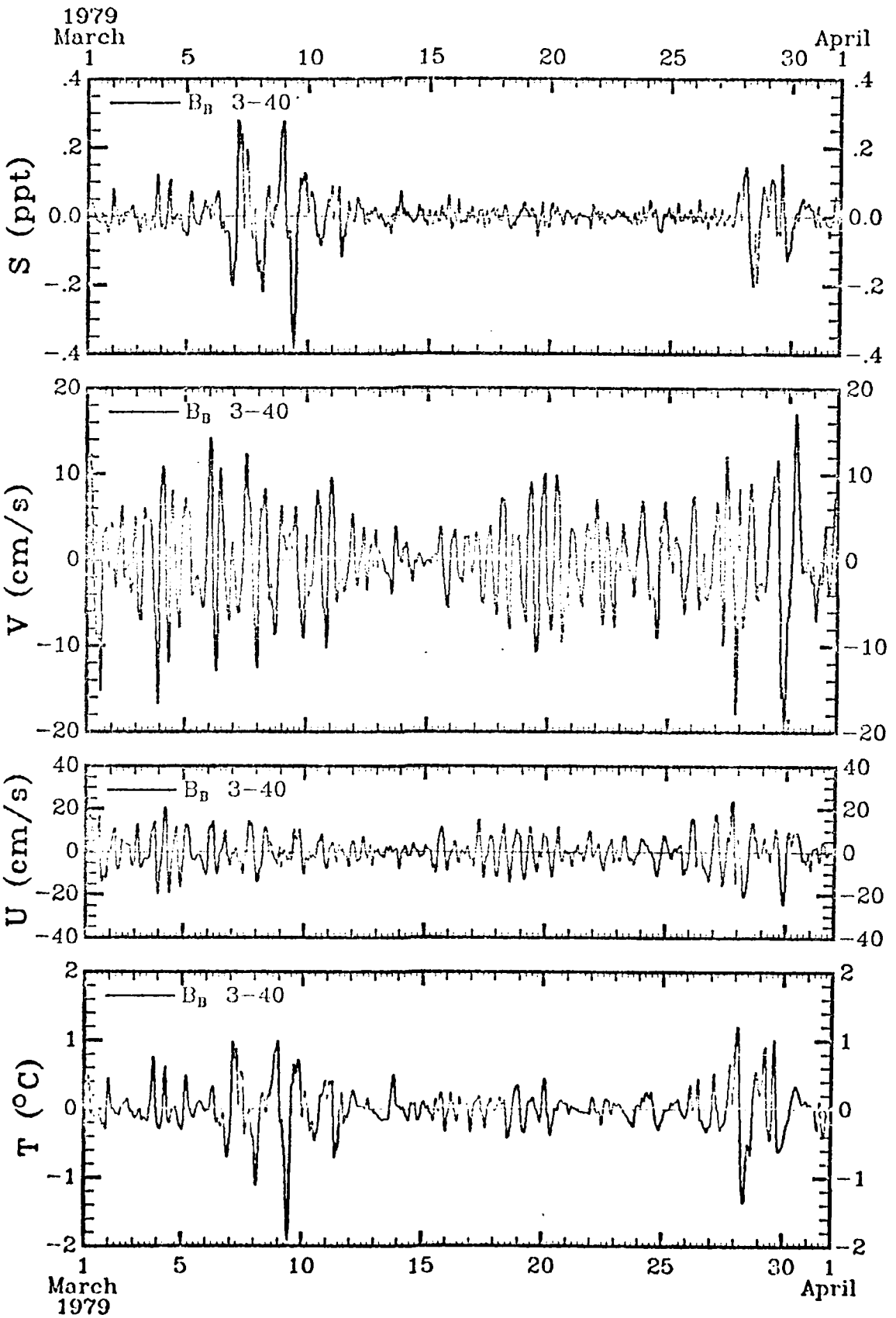

1979
March
April
1
5
10
15
20
25
30
B_T 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
Date/Time

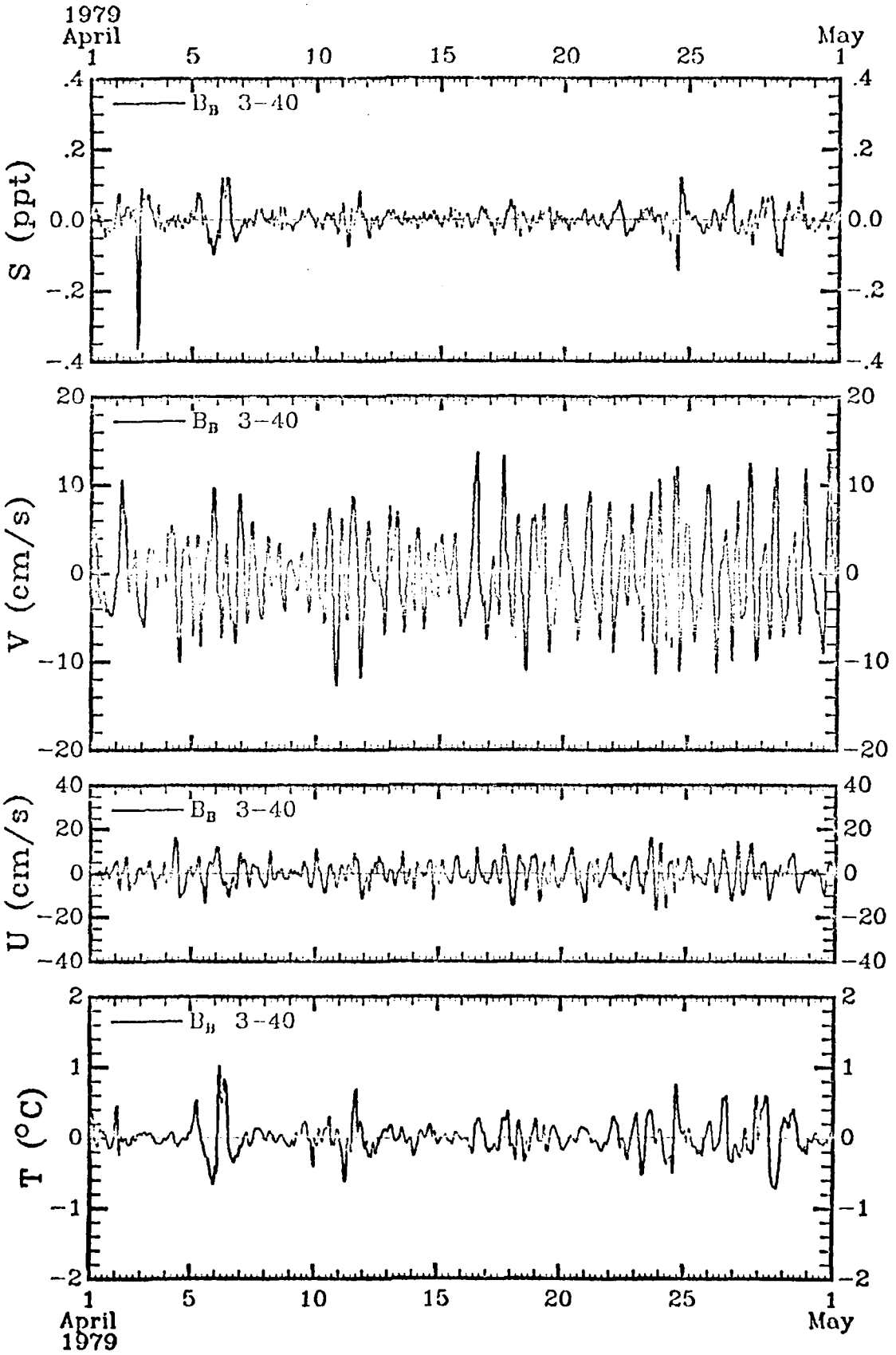

1979
April
May
1
5
10
15
20
25
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
B_T 3–40
.5
0.0
−.5
40
20
0
−20
−40
50
−50
4
2
−2
April
1979
May
Date/Time

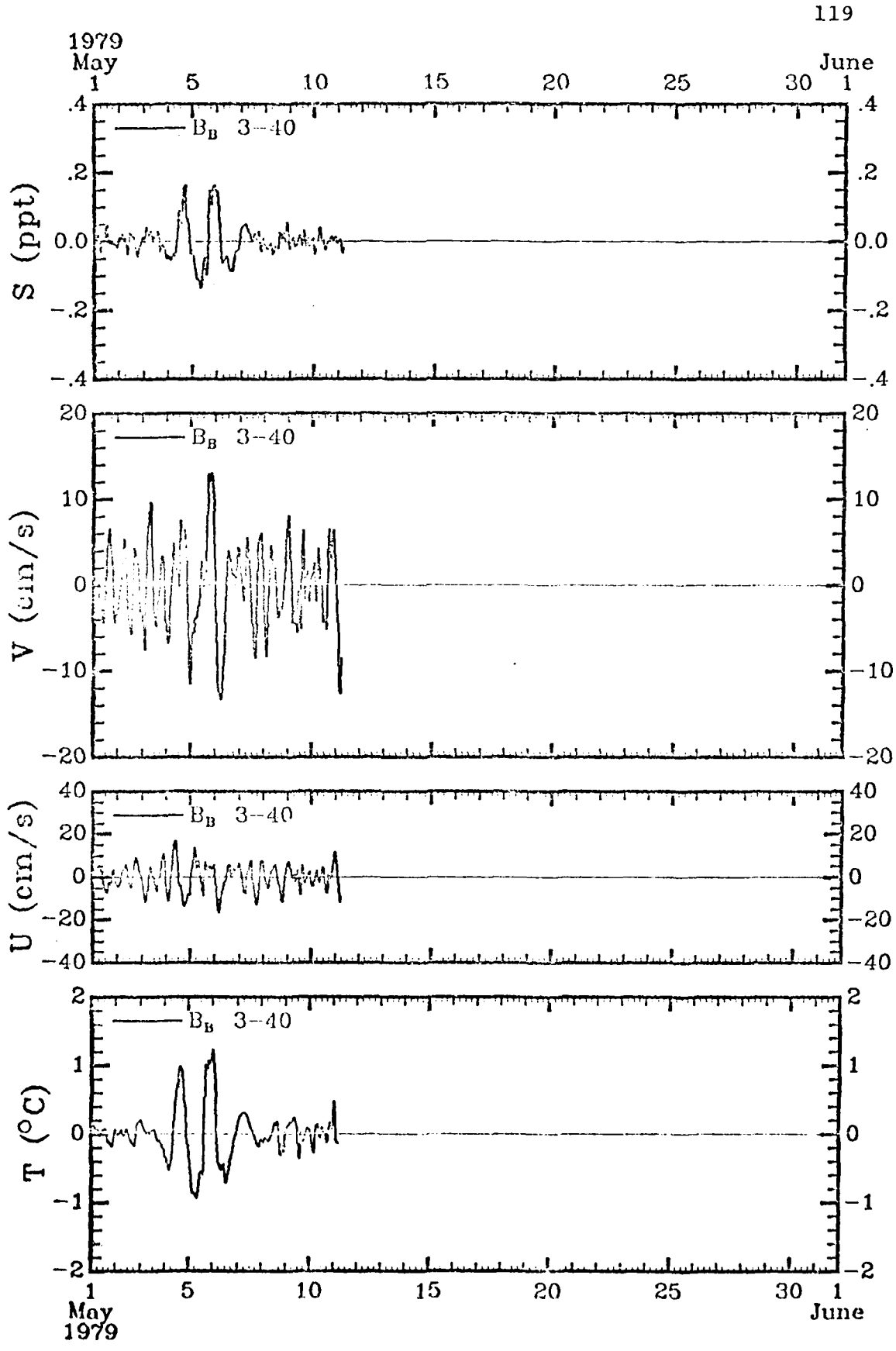

1979
May
June
1
5
10
15
20
25
30
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
B_T 3–40
.5
0.0
-.5
40
20
0
-20
-40
50
-50
4
2
-2
May
1979
June
Date/Time

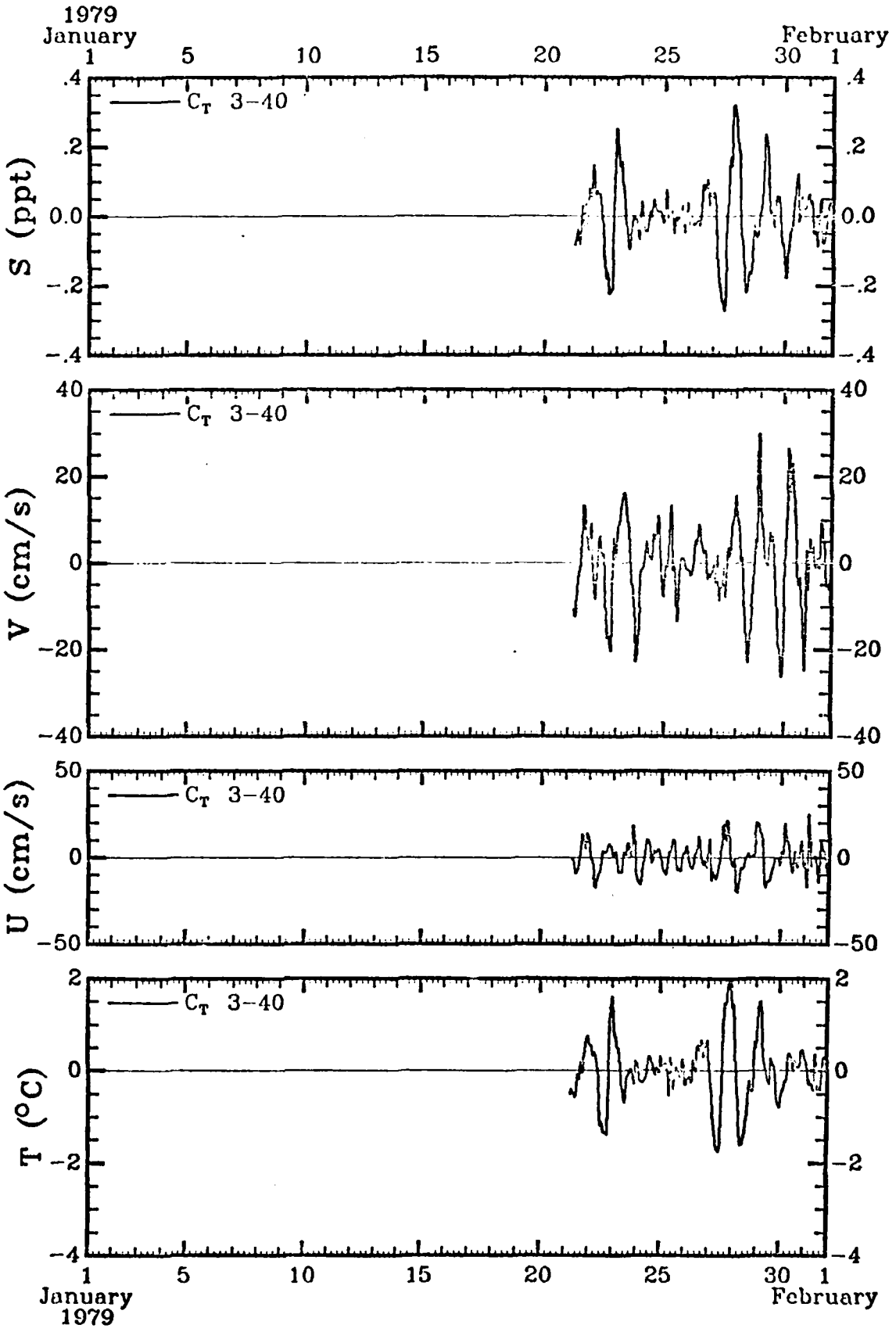

1979
January
February
1 5 10 15 20 25 30 1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
B_B 3-40
Date/Time

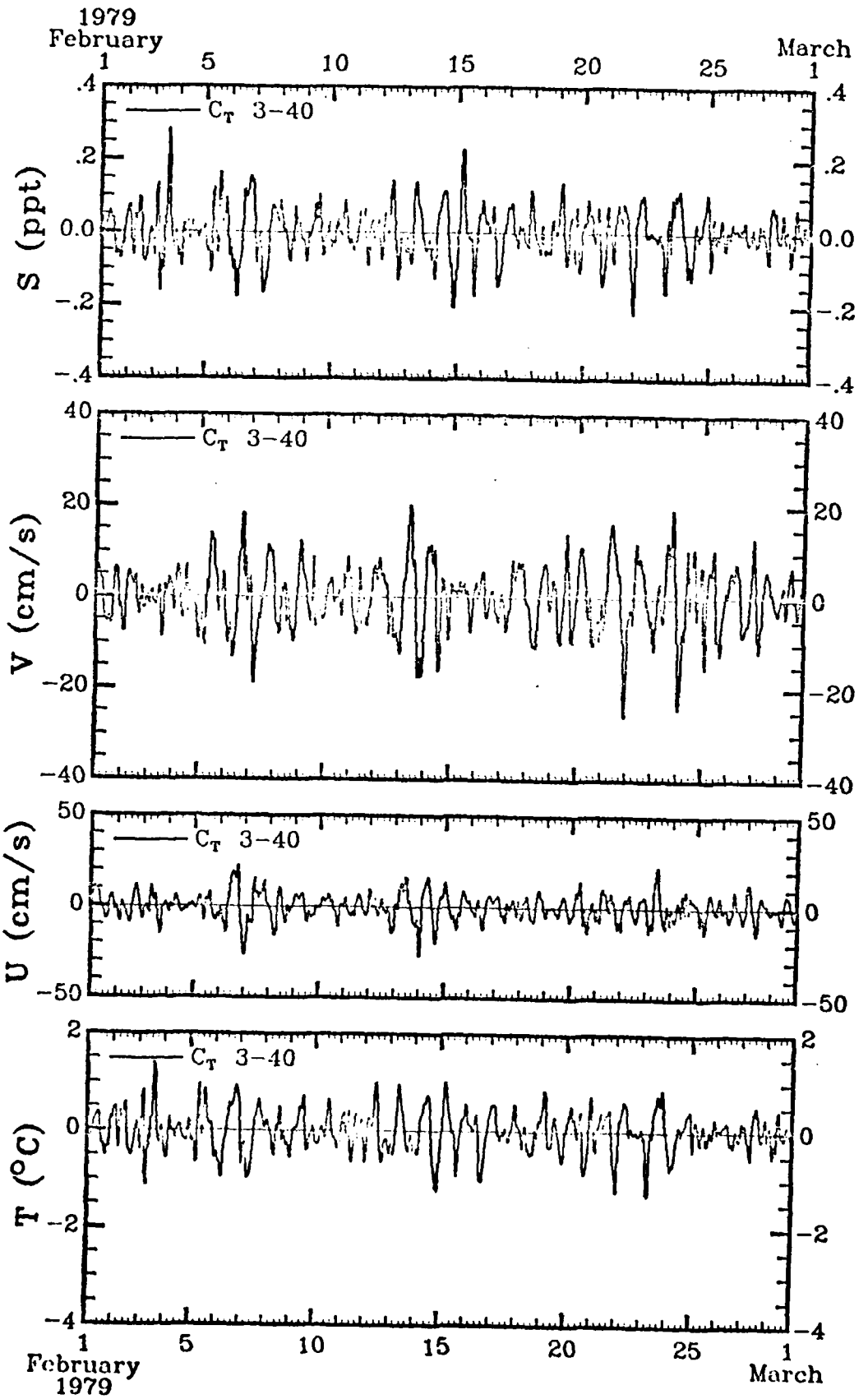

1979
February
March
1
5
10
15
20
25
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
B_B 3-40
.4
.2
0.0
-.2
-.4
20
10
0
-10
-20
40
-40
2
1
-1
-2
February
1979
March
Date/Time

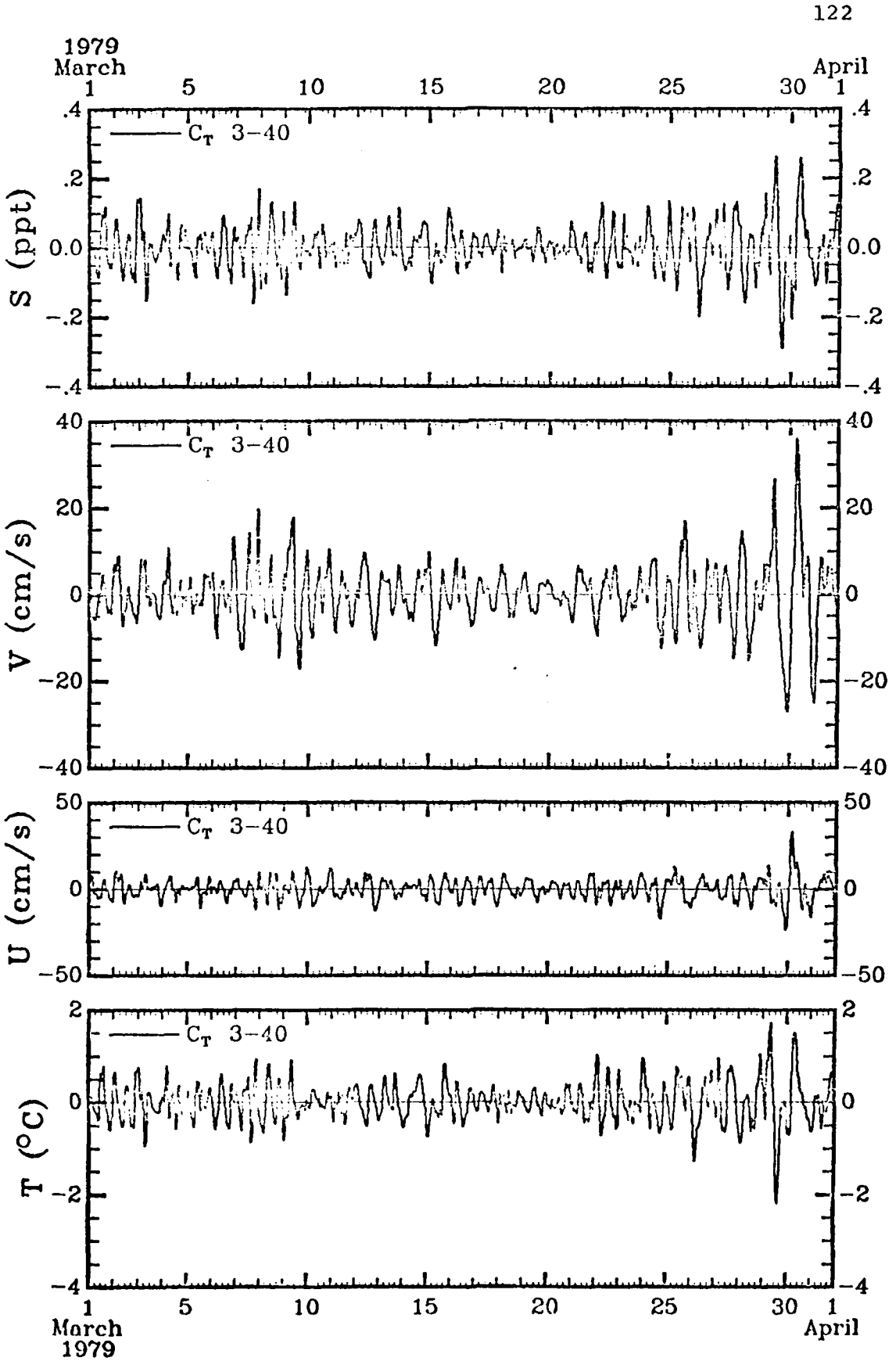

1979
March
April
1 5 10 15 20 25 30 1
B_B 3–40
S (ppt)
.4 .2 0.0 −.2 −.4
V (cm/s)
20 10 0 −10 −20
U (cm/s)
40 20 0 −20 −40
T (°C)
2 1 0 −1 −2
1 5 10 15 20 25 30 1
March
1979
April
Date/Time


1979
April
1
5
10
15
20
25
May
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
B_B 3–40
.4
.2
0.0
−.2
−.4
20
10
0
−10
−20
40
−40
2
1
−1
−2
Date/Time


1979
May
June
1
5
10
15
20
25
30
1
B_B 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
.4
.2
0.0
−.2
−.4
20
10
0
−10
−20
40
−40
2
1
−1
−2
May
1979
June
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
C_T 3–40
S (ppt)
.4
.2
0.0
–.2
–.4
V (cm/s)
40
20
0
–20
–40
U (cm/s)
50
0
–50
T (°C)
2
0
–2
–4
1 5 10 15 20 25 30 1
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
C_T 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
Date/Time


1979
March
1
5
10
15
20
25
30
April
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_T 3–40
.4
.2
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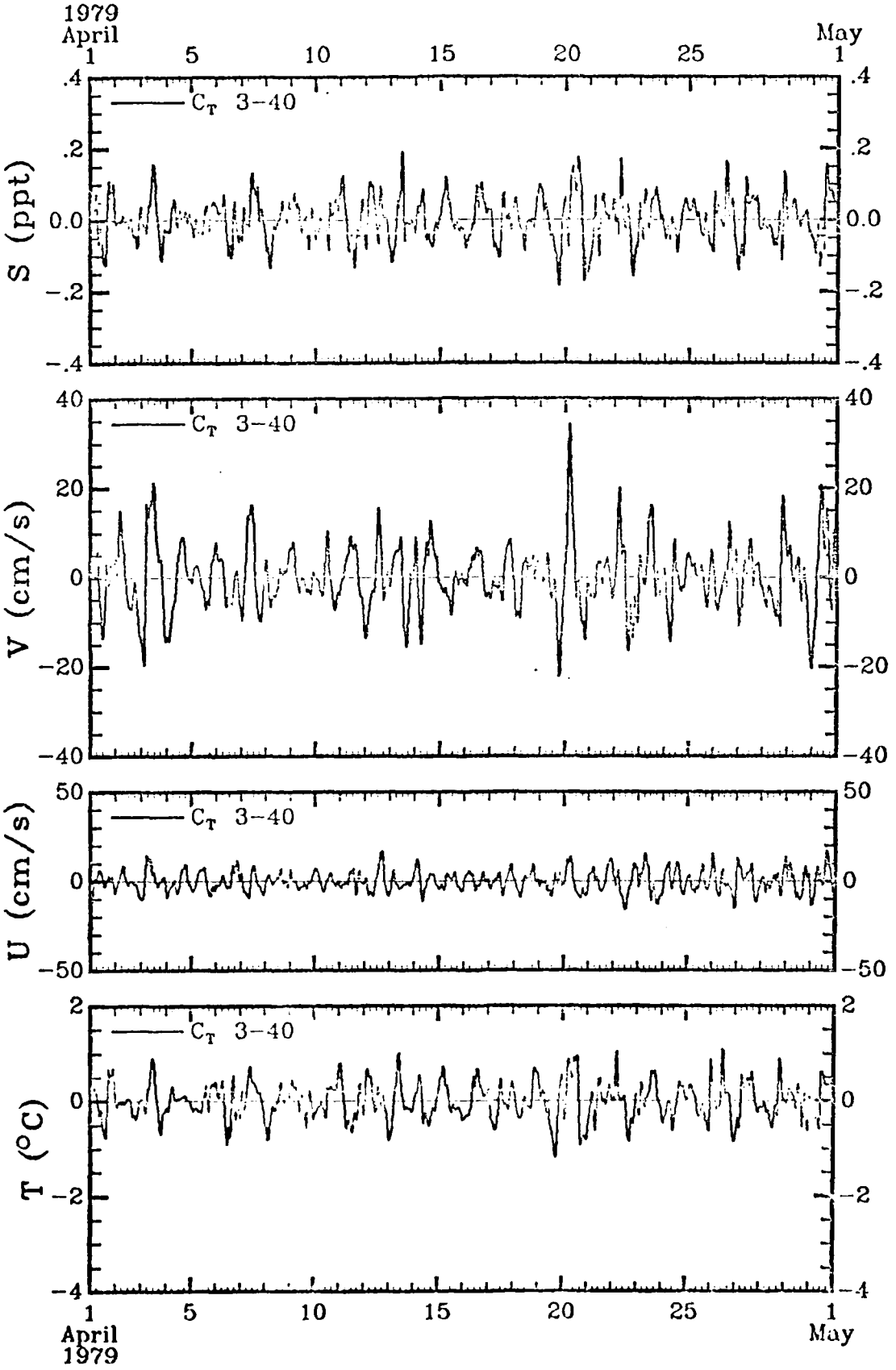
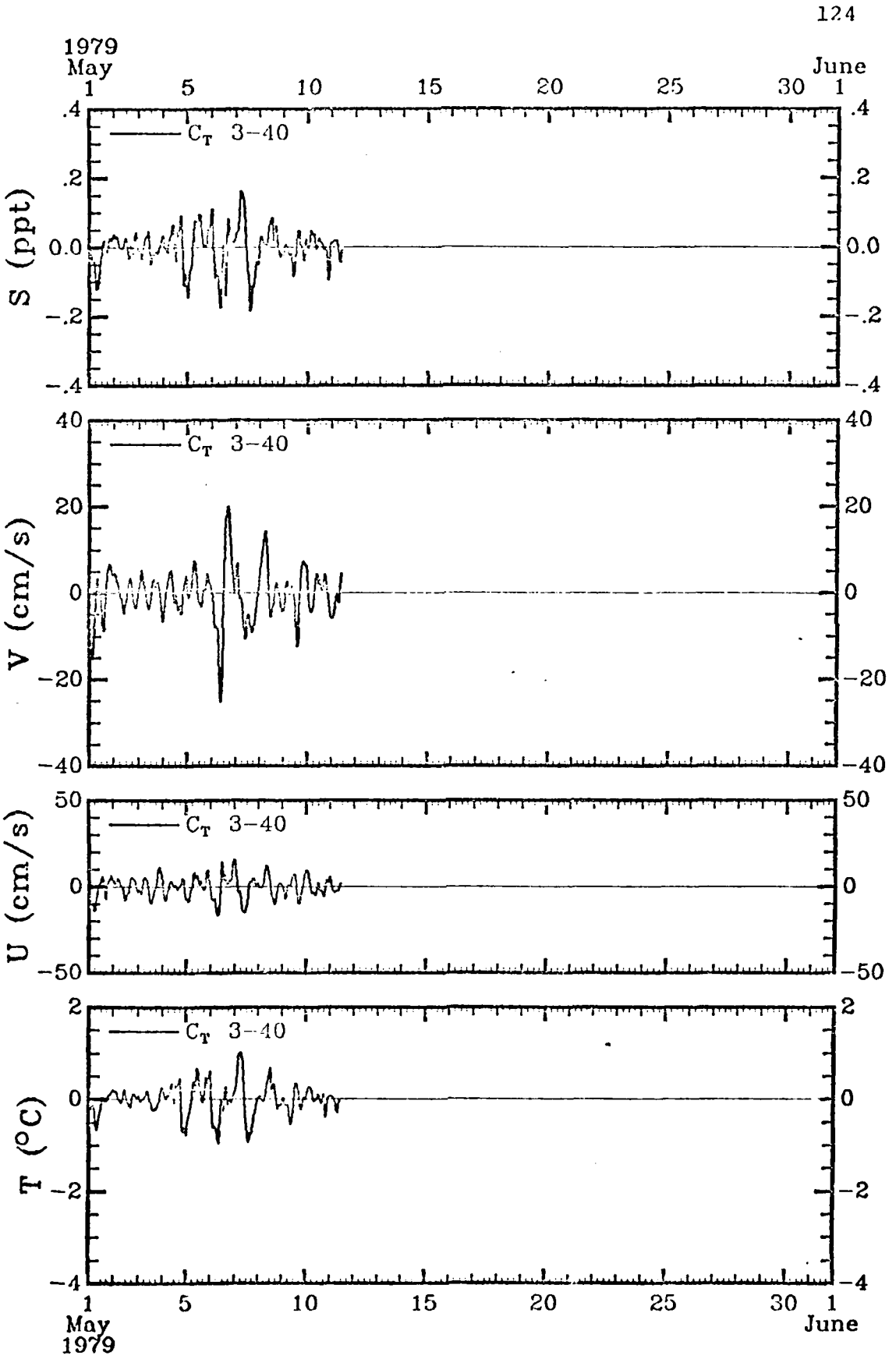
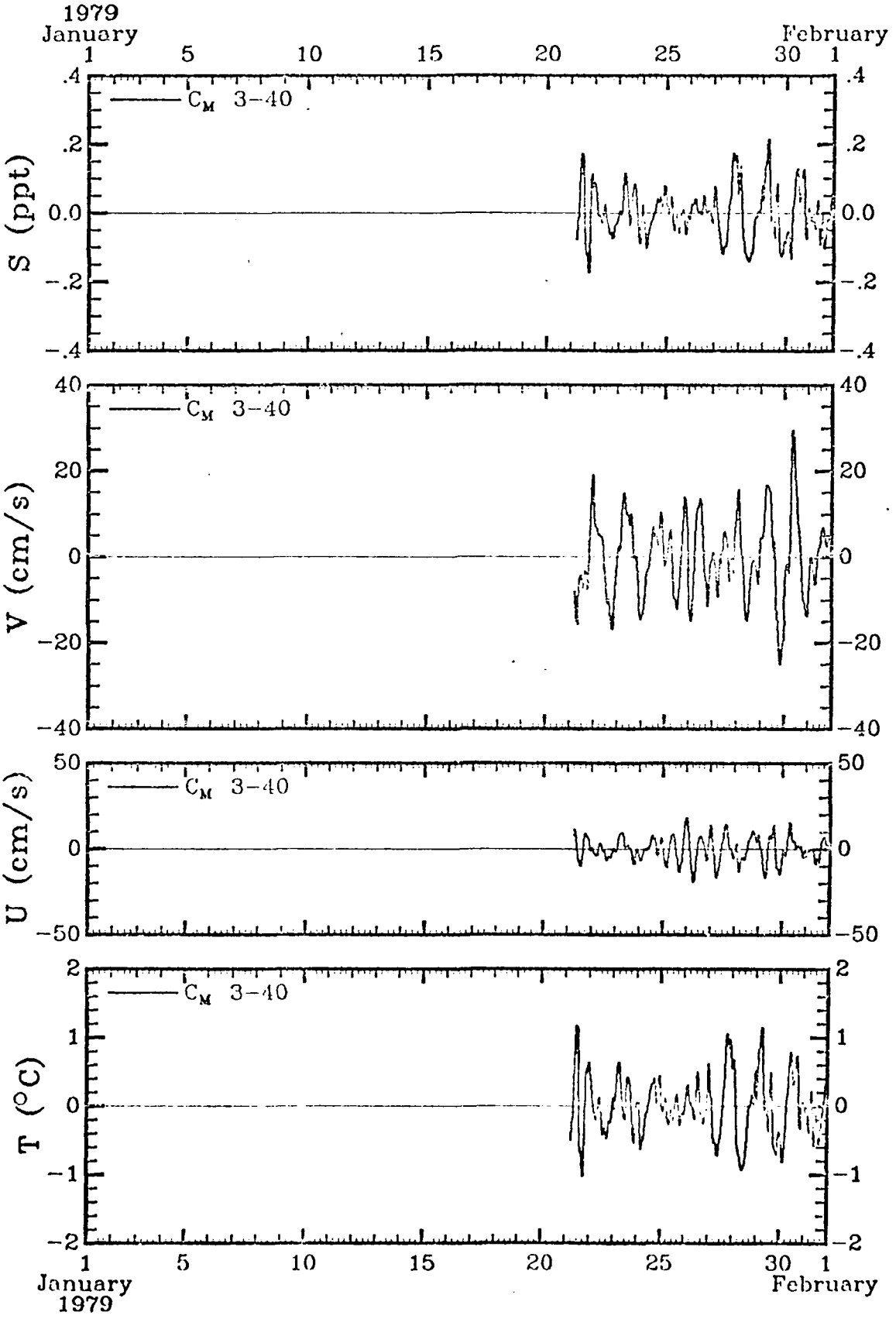
−.2
−.4
40
20
0
−20
−40
50
0
−50
2
−2
−4

Date/Time

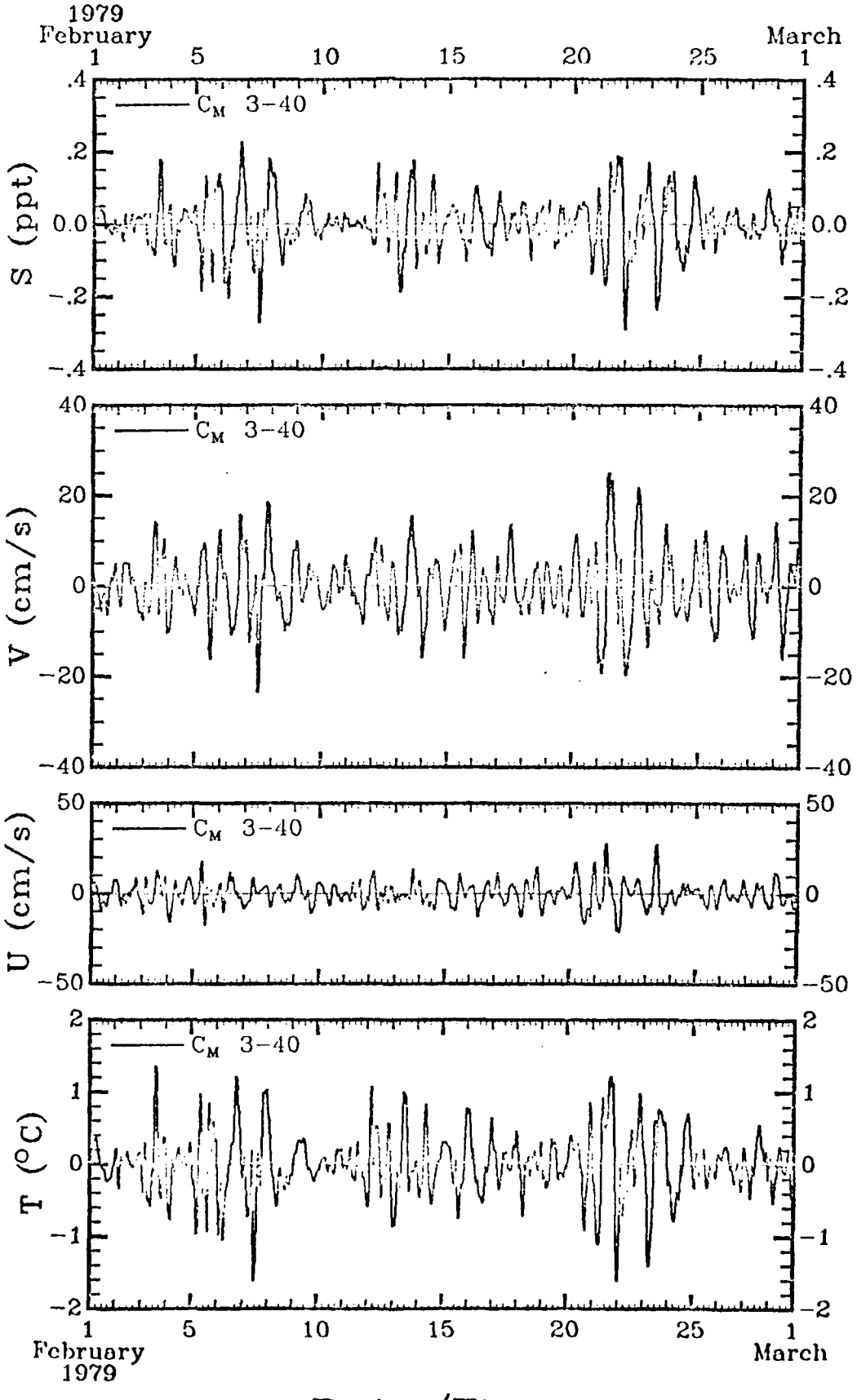

1979
April
May
1
5
10
15
20
25
1
C_T 3–40
S (ppt)
.4
.2
0.0
–.2
–.4
V (cm/s)
40
20
0
–20
–40
U (cm/s)
50
0
–50
T (°C)
2
0
–2
–4
1
April
1979
Date/Time

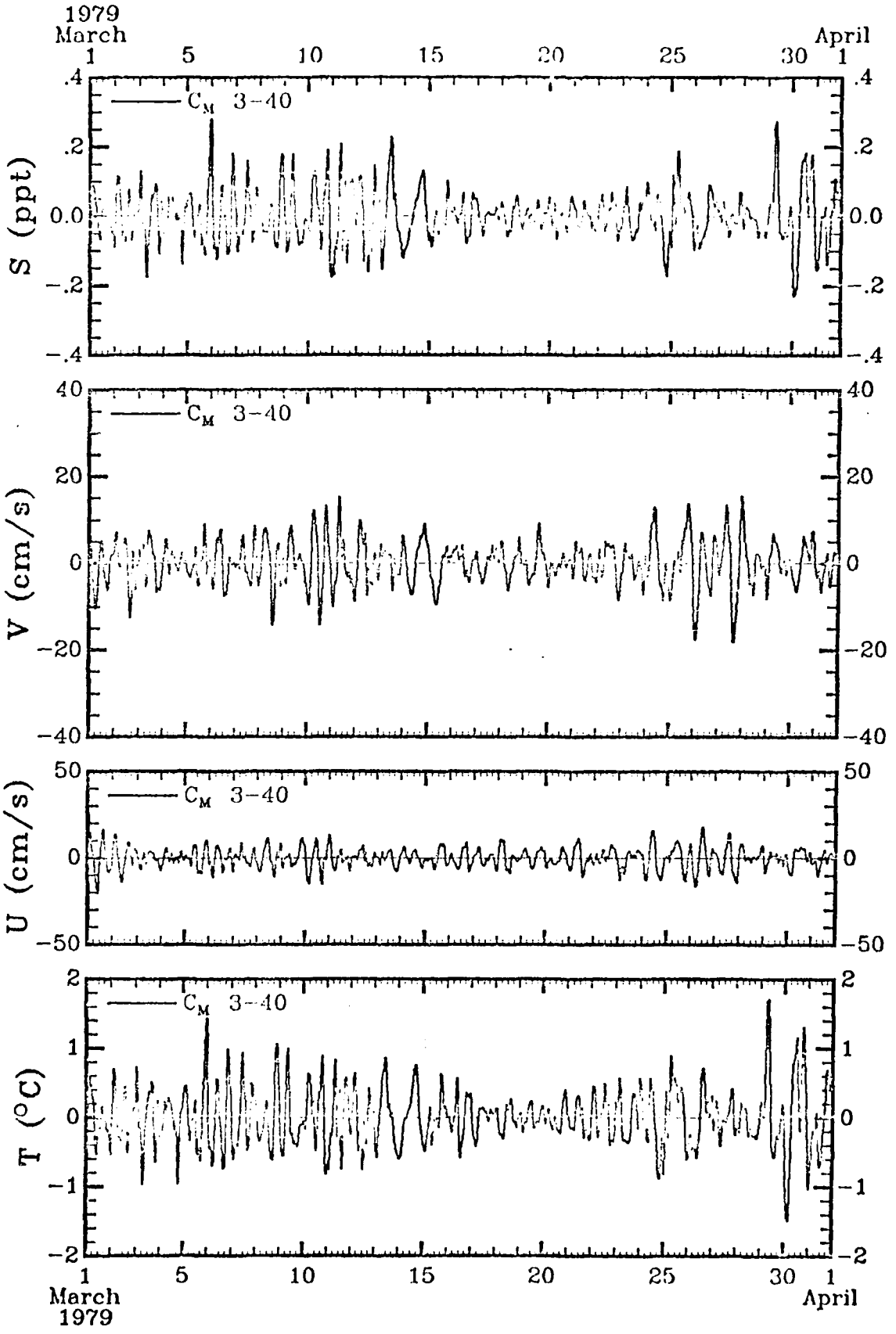

1979
May
1
5
10
15
20
25
30
June
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_T 3-40
.4
.2
0.0
-.2
-.4
40
20
0
-20
-40
50
0
-50
2
0
-2
-4
1
5
10
15
20
25
30
1
May
1979
June

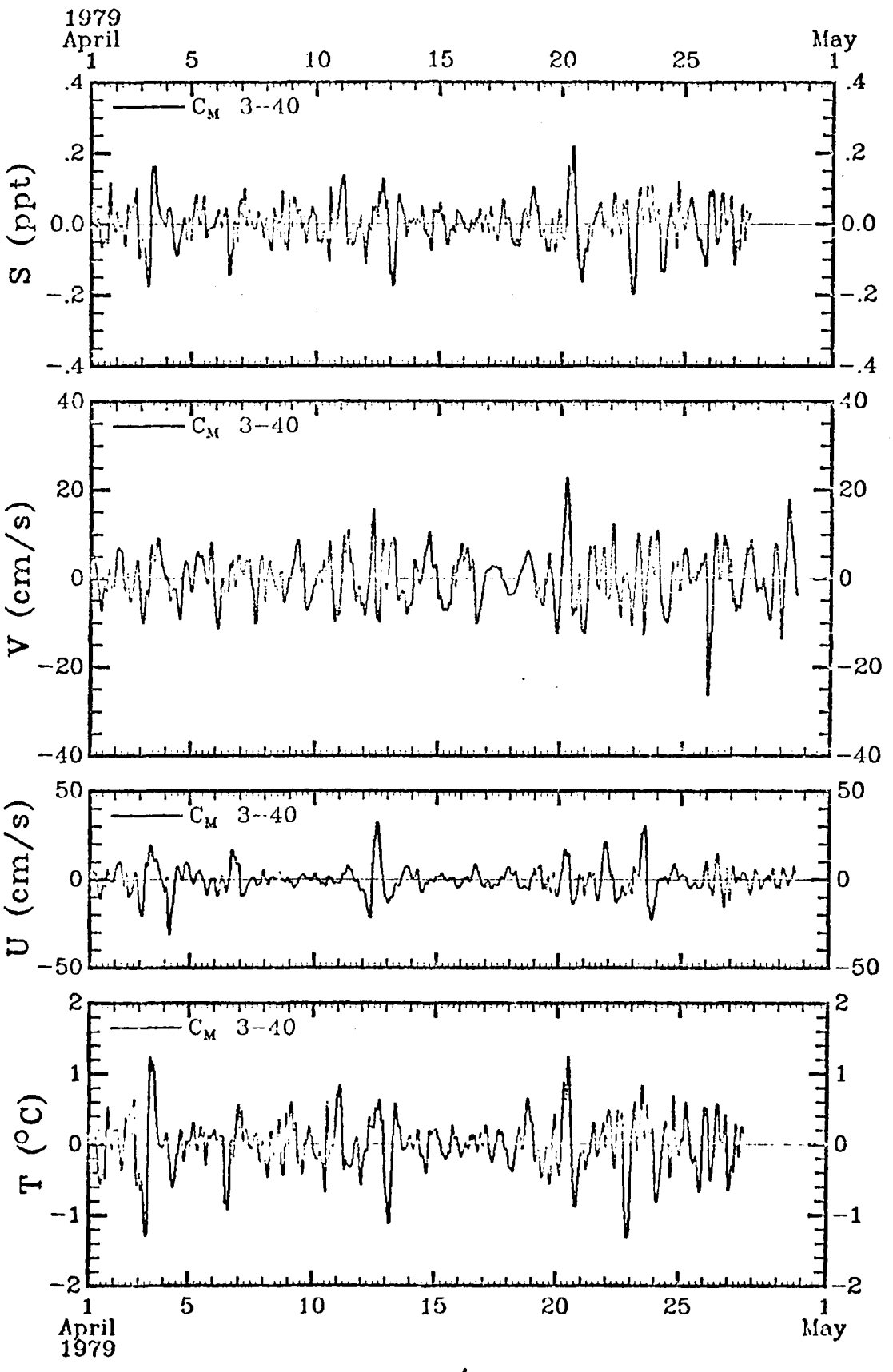
Date/Time

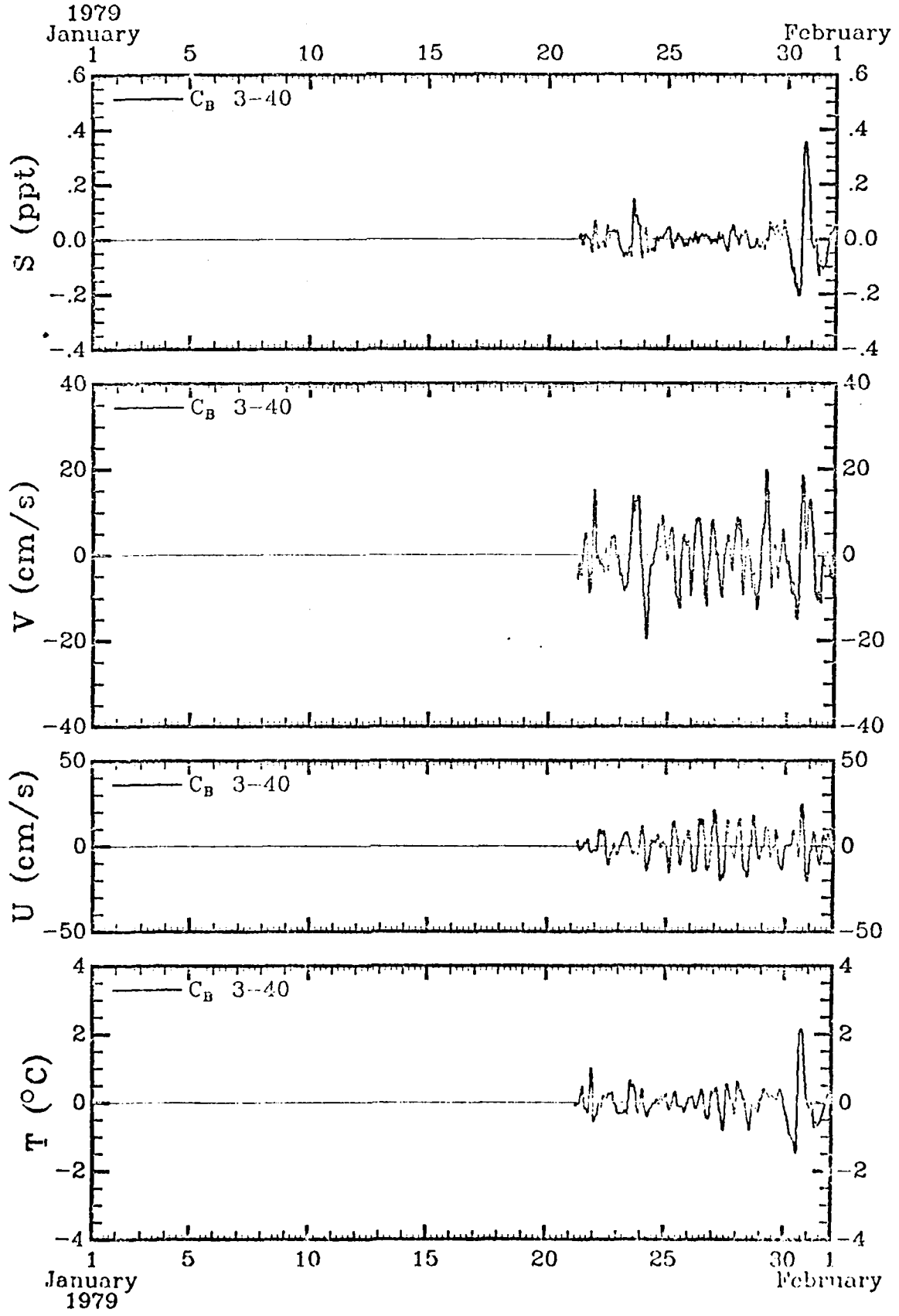

1979
January
February
1 5 10 15 20 25 30 1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_M 3-40
.4
.2
0.0
-.2
-.4
40
20
0
-20
-40
50
0
-50
2
1
0
-1
-2
1 5 10 15 20 25 30 1
January
1979
February

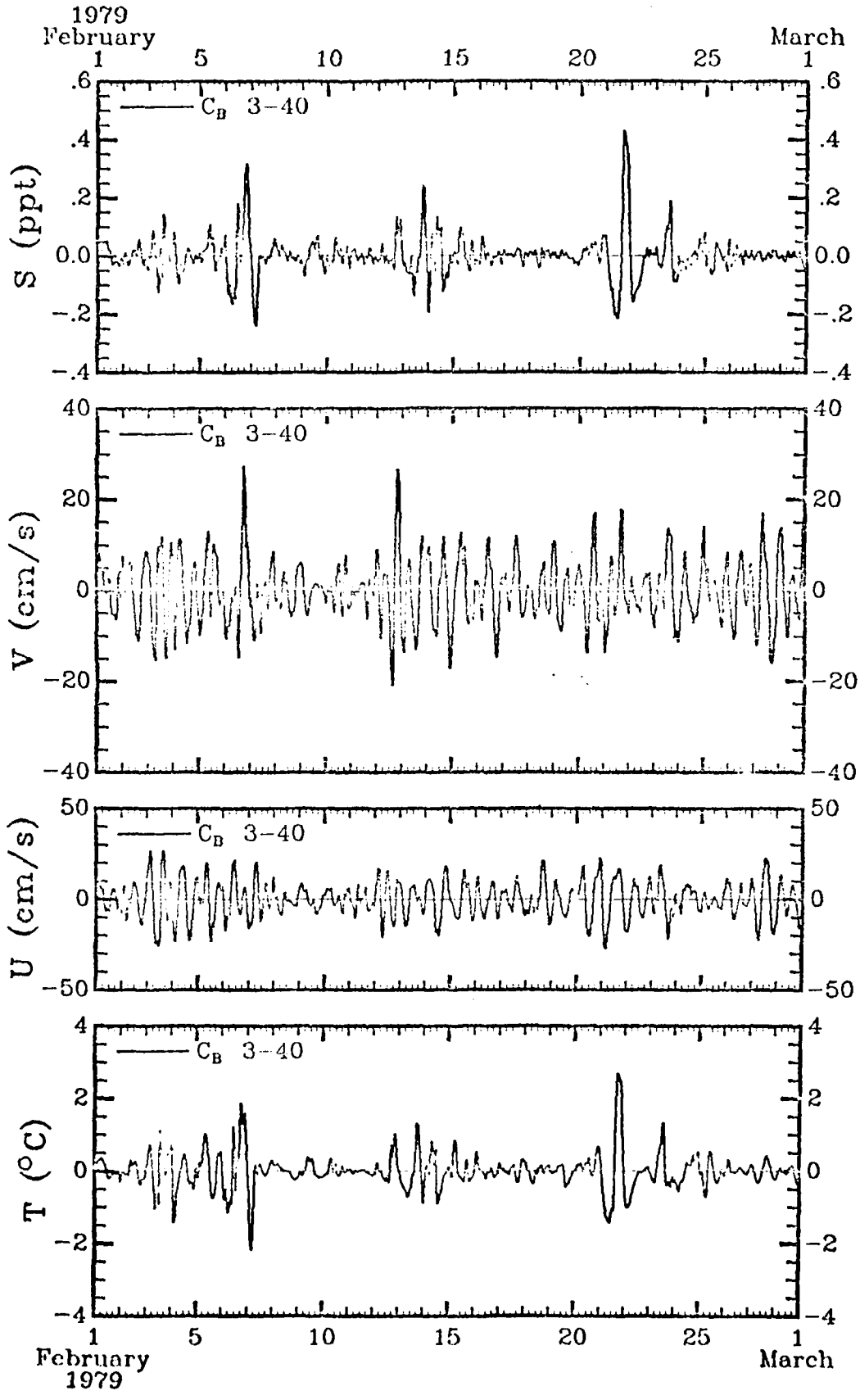
Date/Time

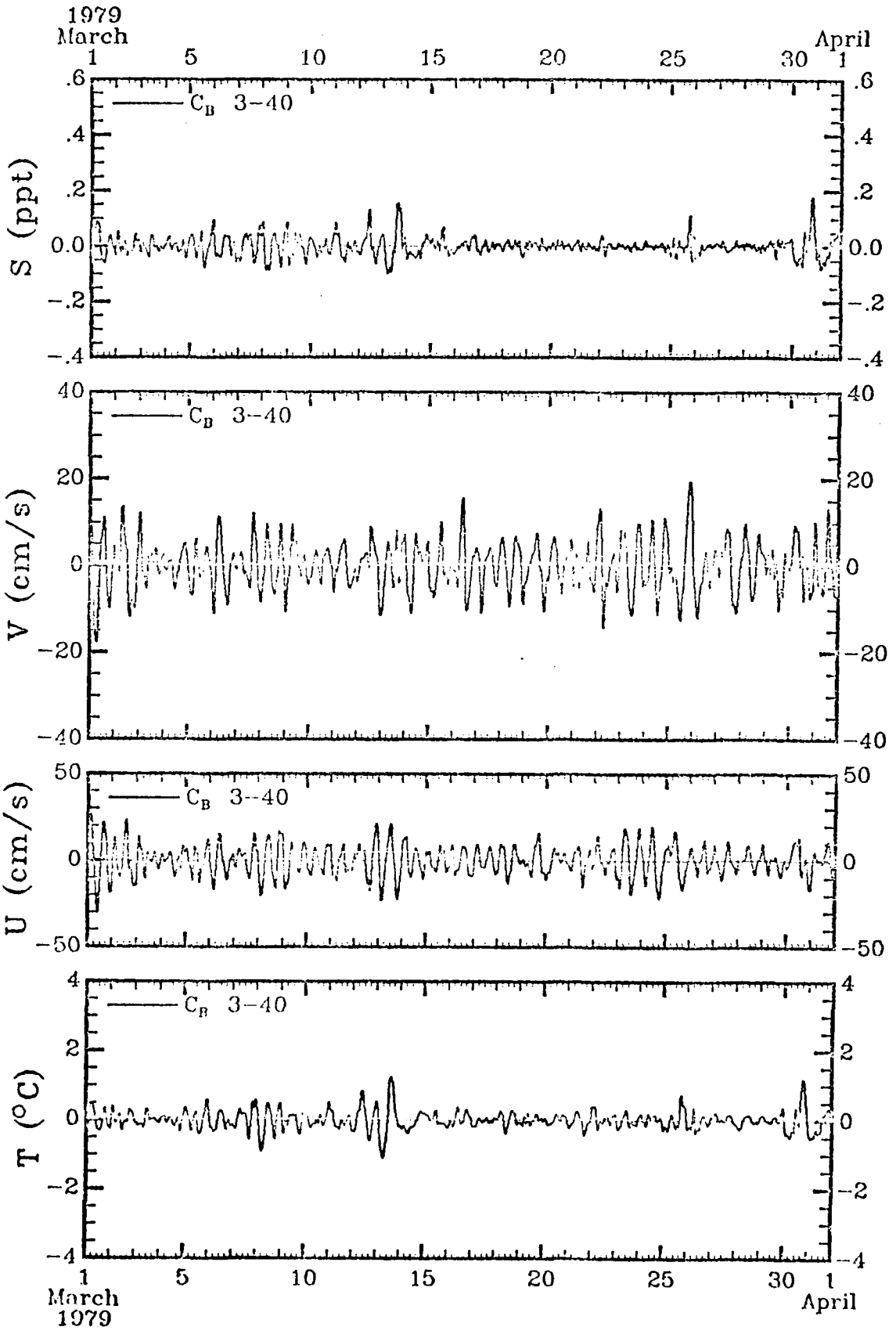

1979
February
March
1
5
10
15
20
25
1
C_M 3–40
S (ppt)
.4
.2
0.0
−.2
−.4
V (cm/s)
40
20
0
−20
−40
U (cm/s)
50
0
−50
T (°C)
2
1
0
−1
−2
February
1979
March
Date/Time

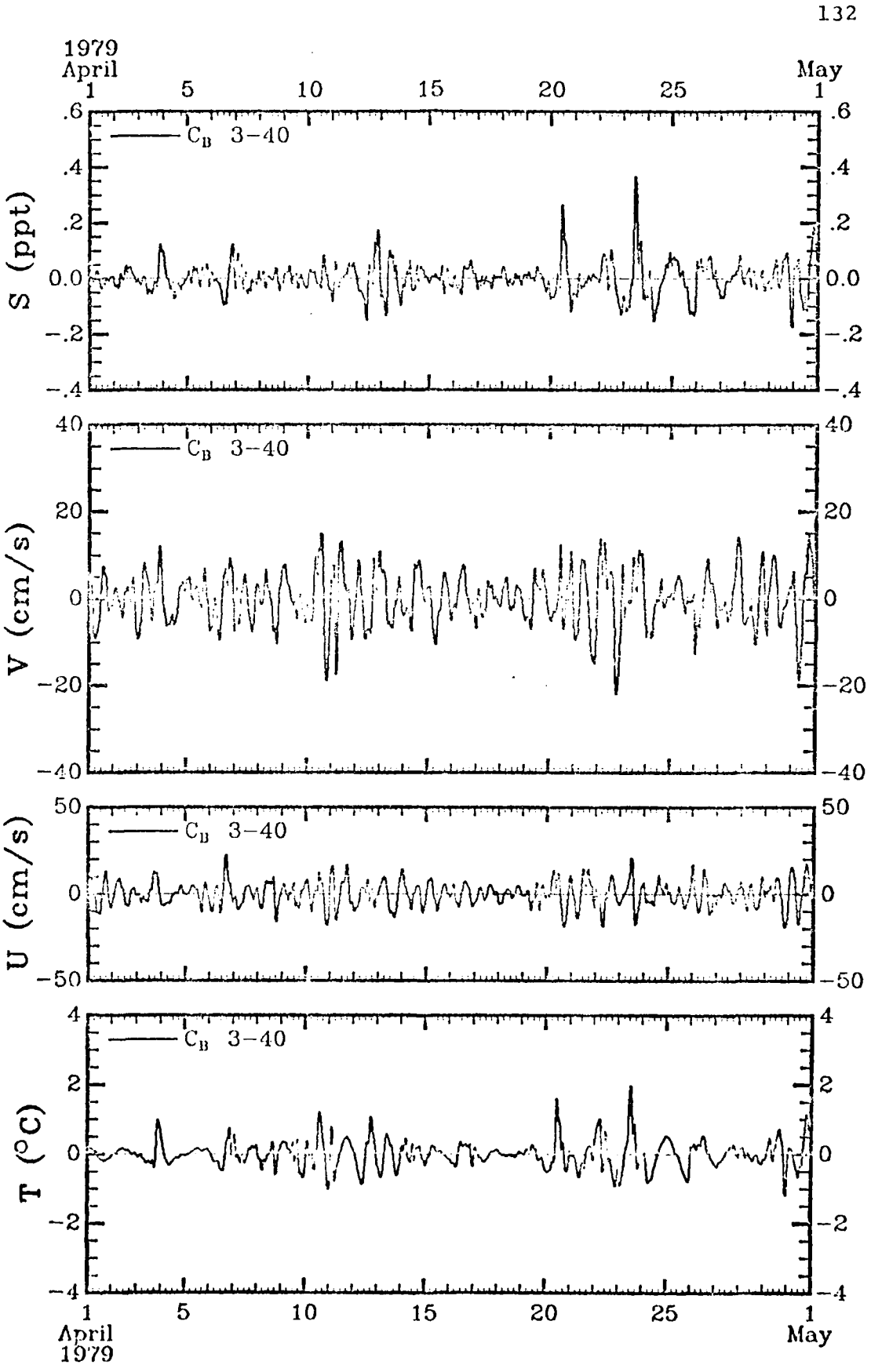

1979
March
April
1 5 10 15 20 25 30 1
C_M 3-40
S (ppt)
.4 .2 0.0 -.2 -.4
V (cm/s)
40 20 0 -20 -40
U (cm/s)
50 0 -50
T (°C)
2 1 0 -1 -2
1 5 10 15 20 25 30 1
March
1979
April
Date/Time


1979
April
May
1
5
10
15
20
25
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_M 3--40
.4
.2
0.0
-.2
-.4
40
20
0
-20
-40
50
-50
2
1
-2
April
1979
May
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
C_B 3-40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
Date/Time


1979
February
March
1 5 10 15 20 25 1
C_B 3-40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
1 5 10 15 20 25 1
February
1979
March
Date/Time


1979
March
April
1
5
10
15
20
25
30
C_B 3–40
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
Date/Time


1979
April
1
5
10
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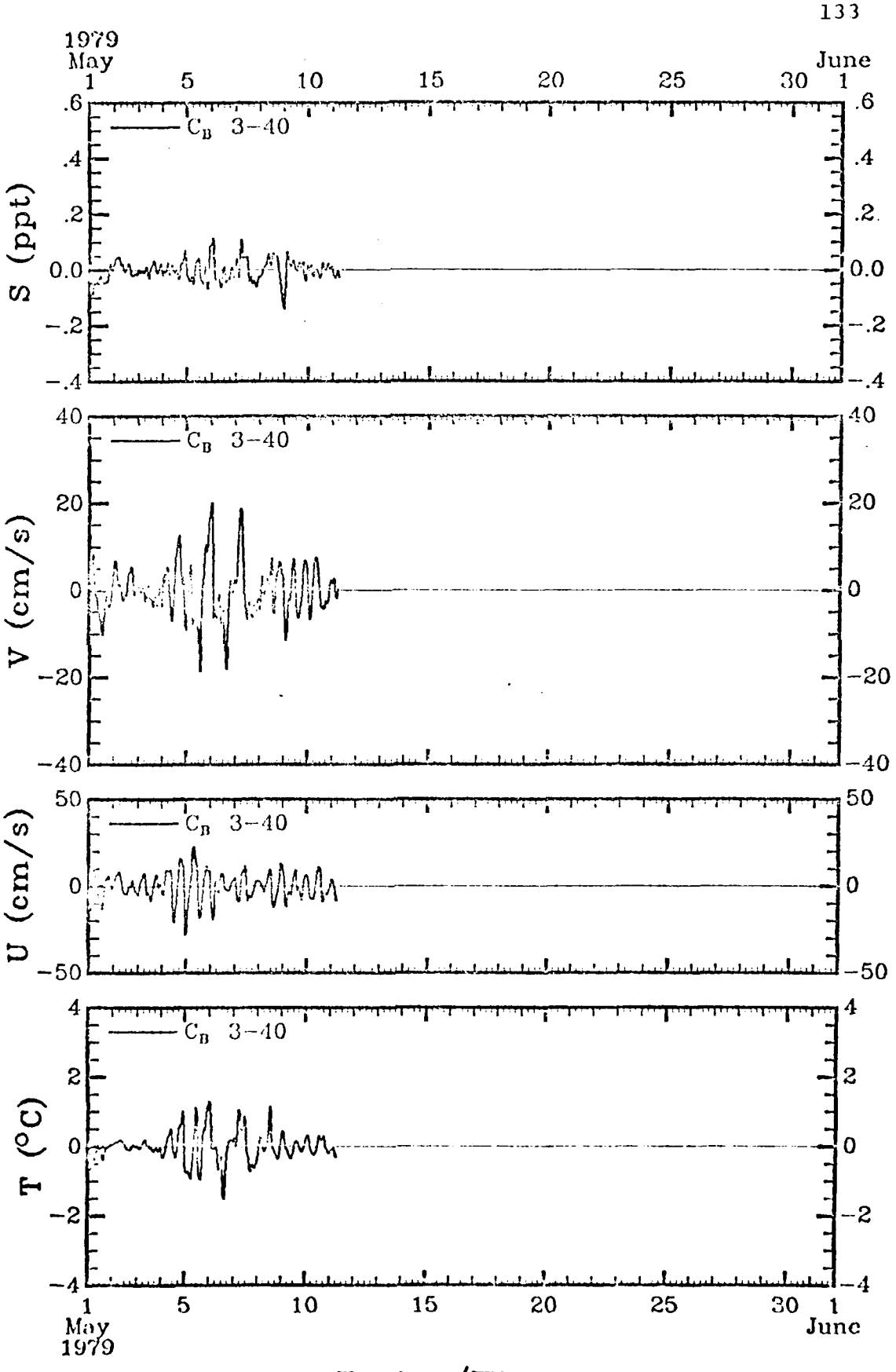
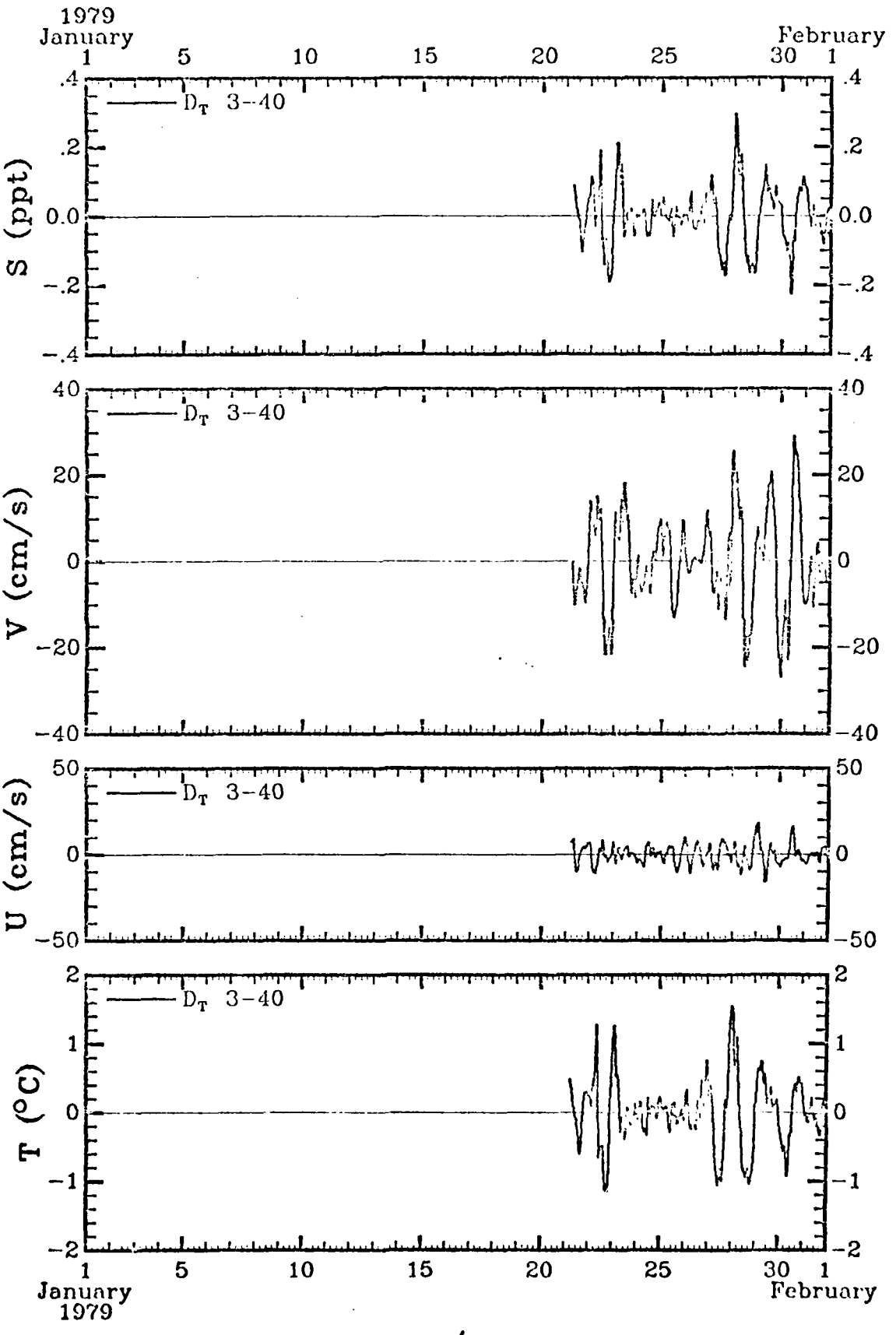
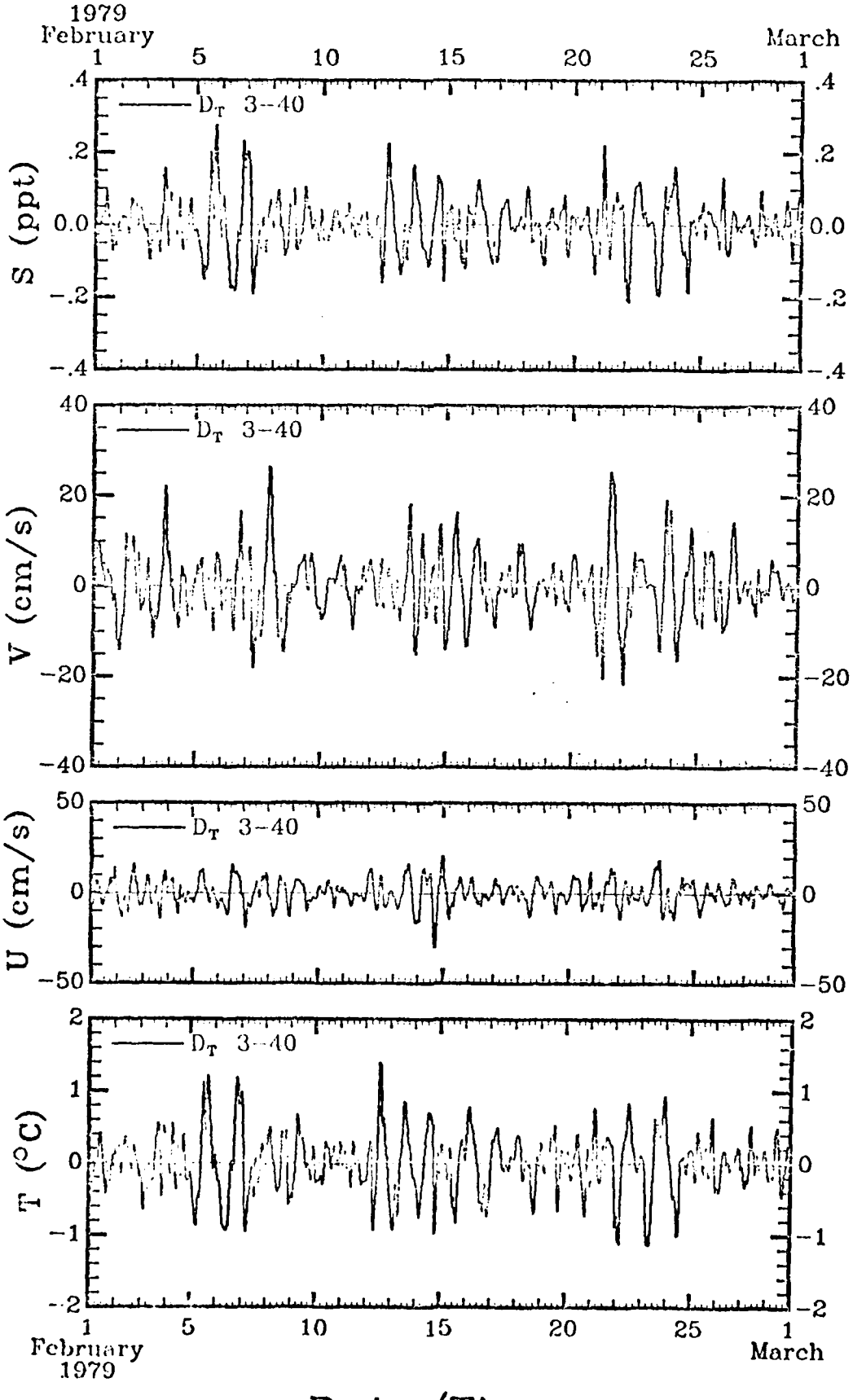
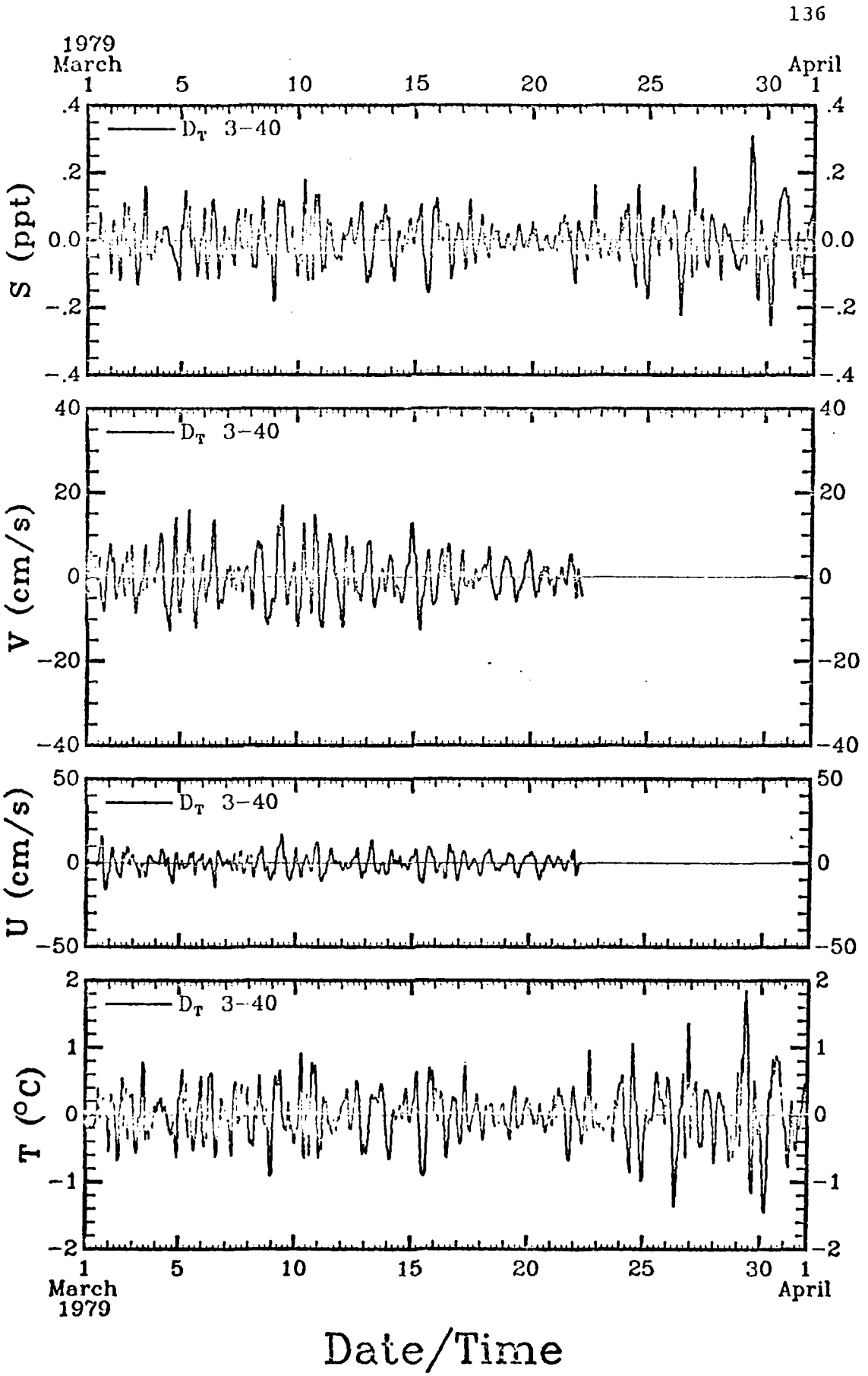
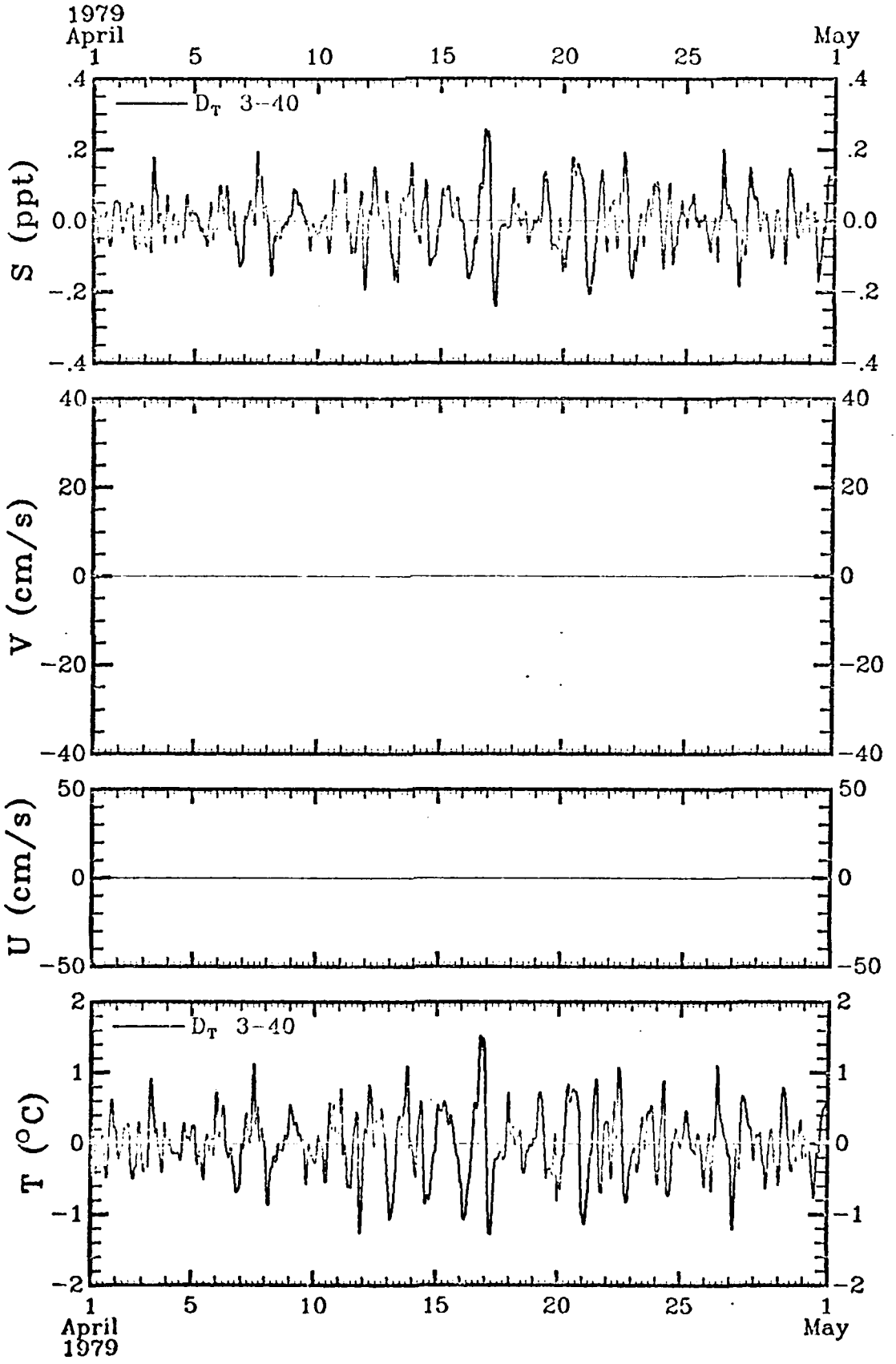
20
25
May
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_B 3-40
Date/Time

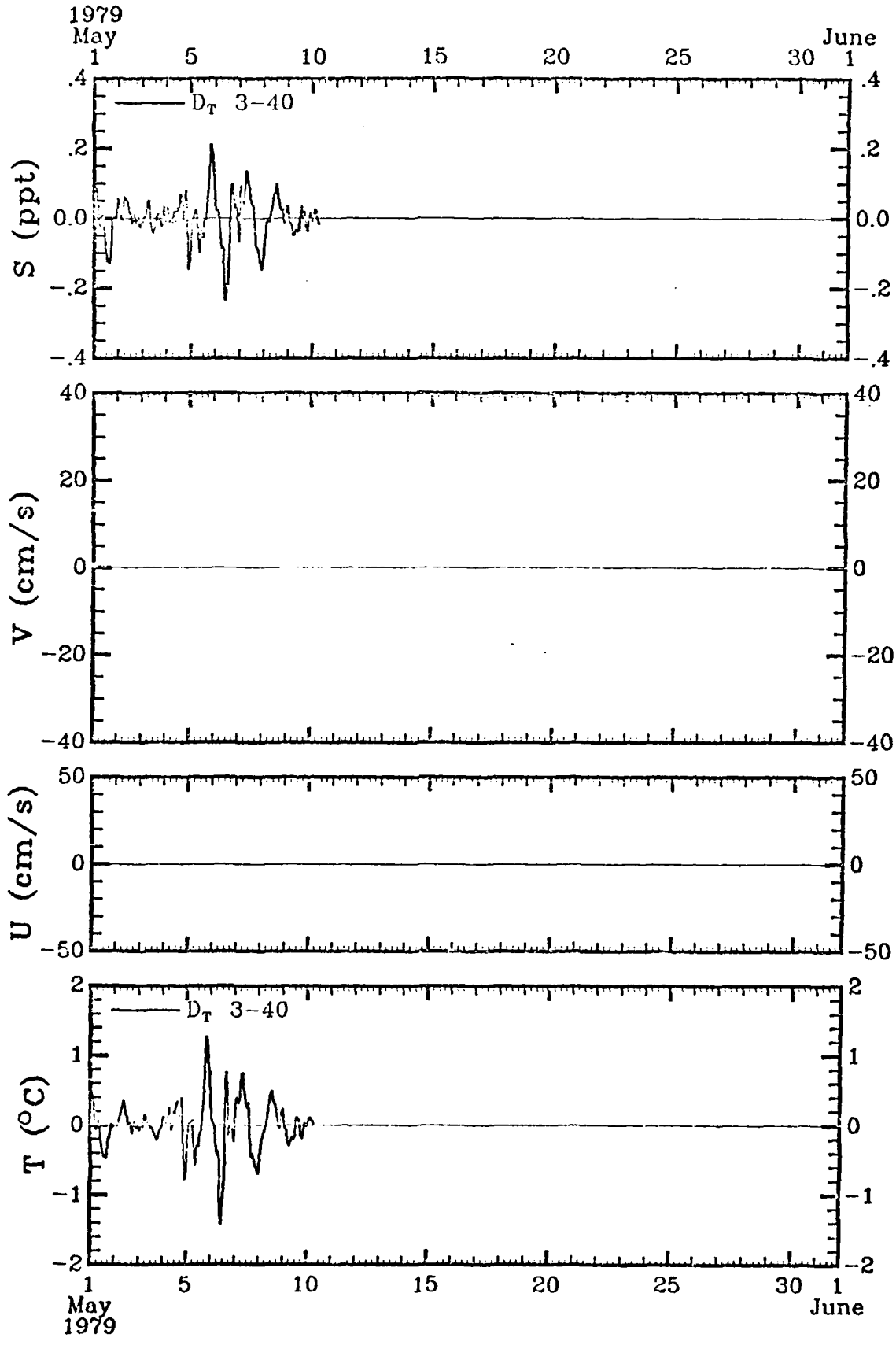

1979
May
June
1
5
10
15
20
25
30
1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
C_B 3-40
.6
.4
.2
0.0
-.2
-.4
40
20
0
-20
-40
50
-50
4
2
-2
-4
May
1979
June
Date/Time

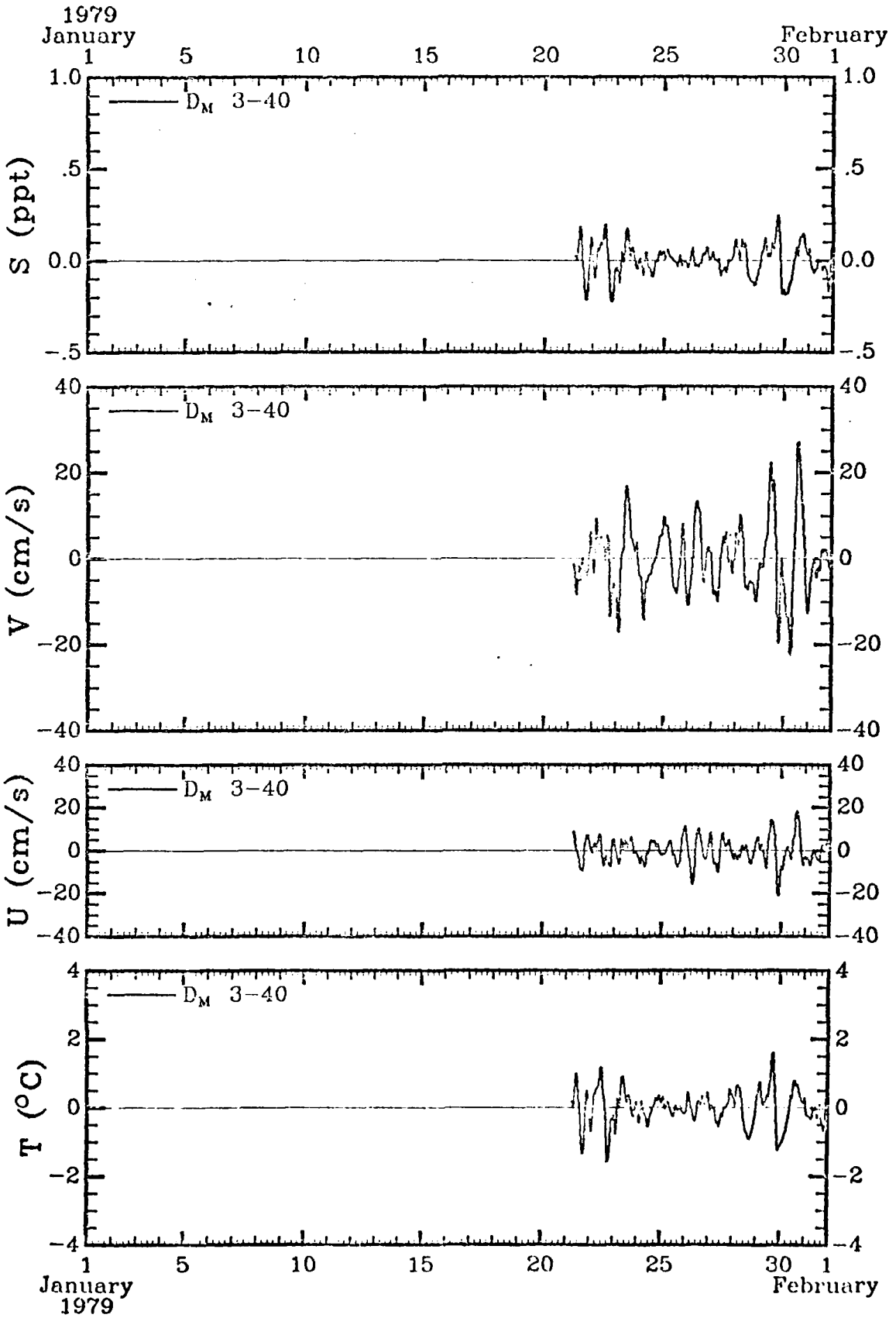

1979
January
February
1 5 10 15 20 25 30 1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
D_T 3–40
.4
.2
0.0
−.2
−.4
40
20
0
−20
−40
50
0
−50
2
1
0
−1
−2
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

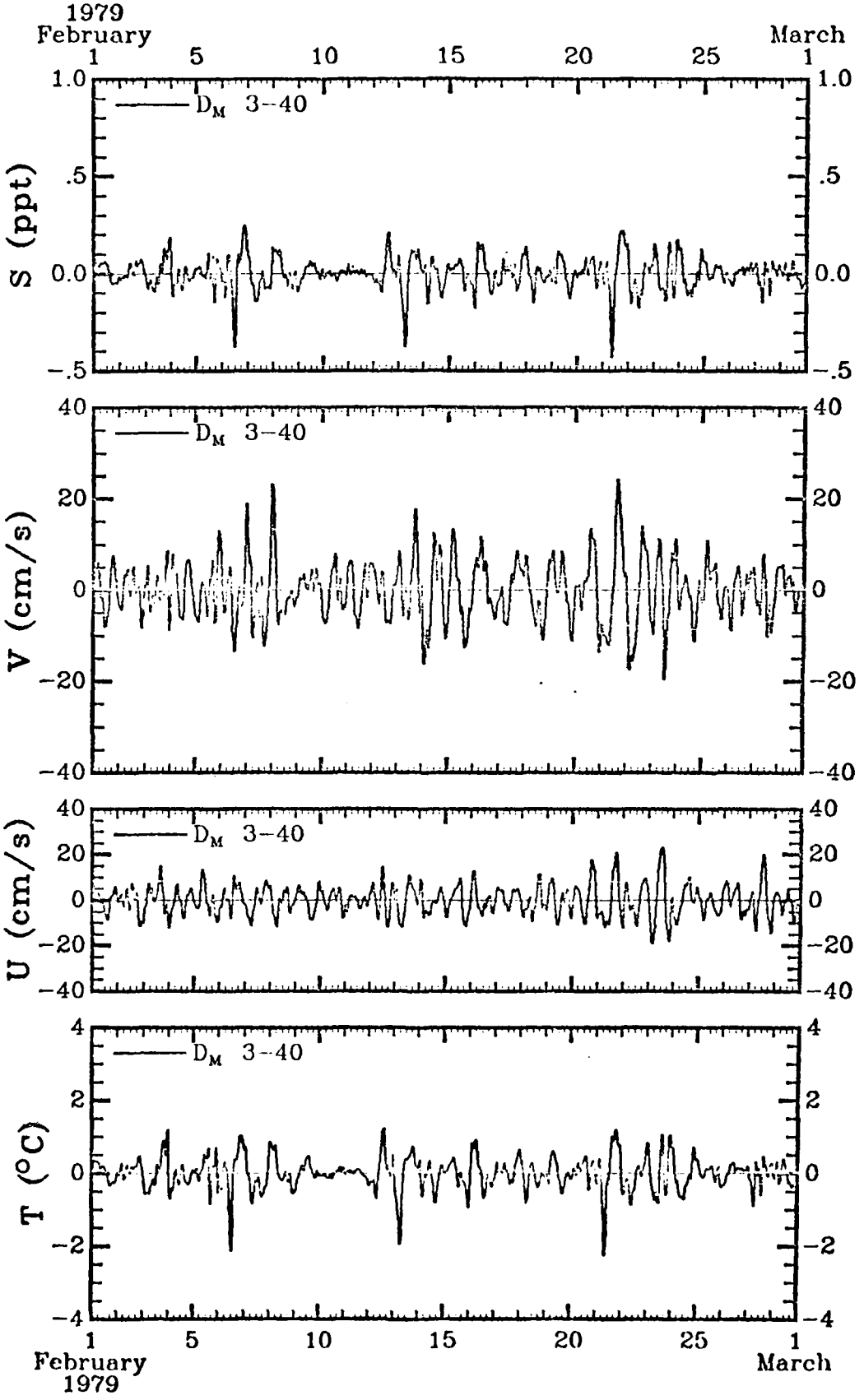

1979
February
March
1
5
10
15
20
25
1
D_T 3–40
S (ppt)
.4
.2
0.0
−.2
−.4
V (cm/s)
40
20
0
−20
−40
U (cm/s)
50
0
−50
T (°C)
2
1
0
−1
−2
February
1979
March
Date/Time

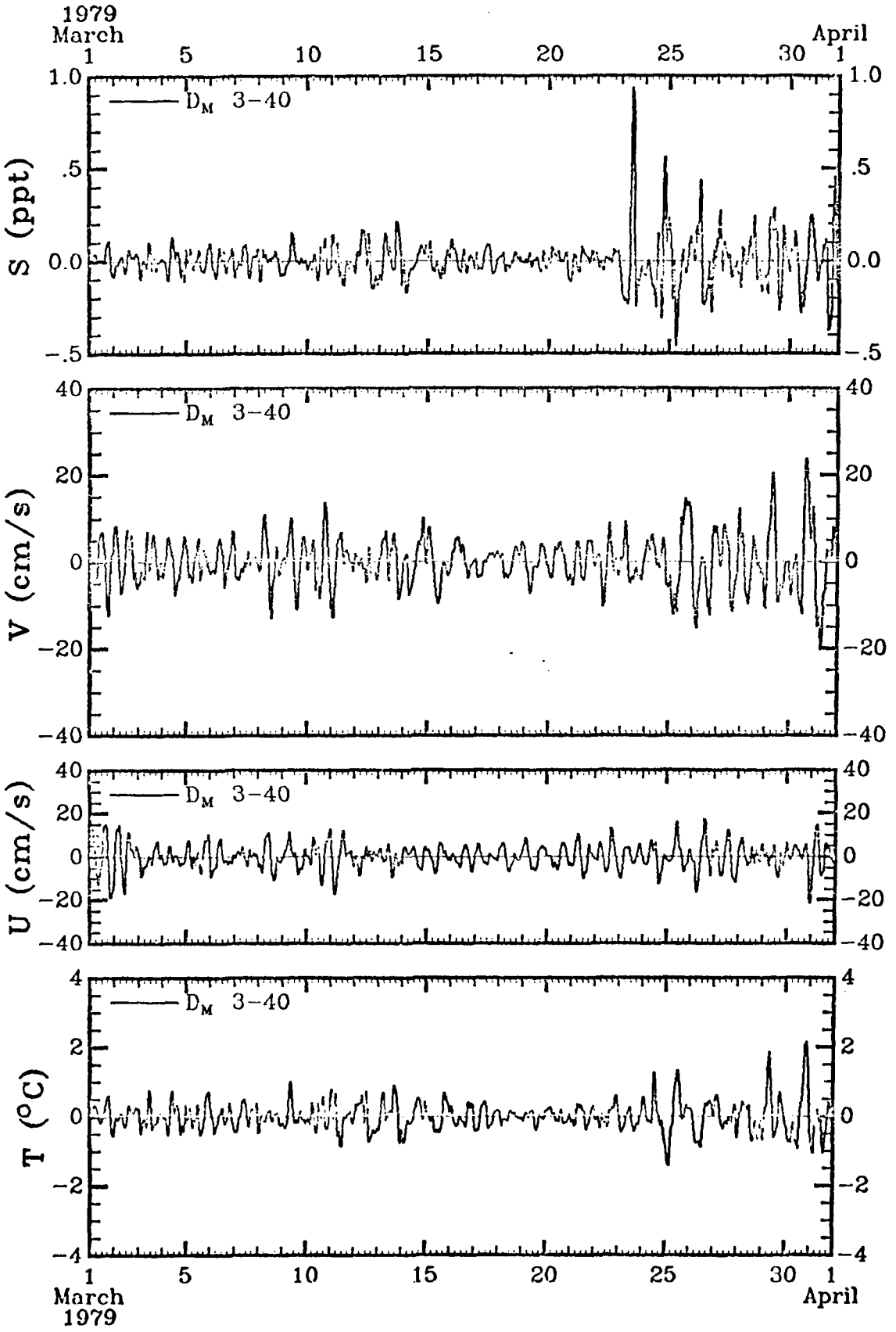

1979
March
April
1 5 10 15 20 25 30 1
D_T 3-40
S (ppt)
.4
.2
0.0
-.2
-.4
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
2
1
0
-1
-2
March
1979
April
Date/Time

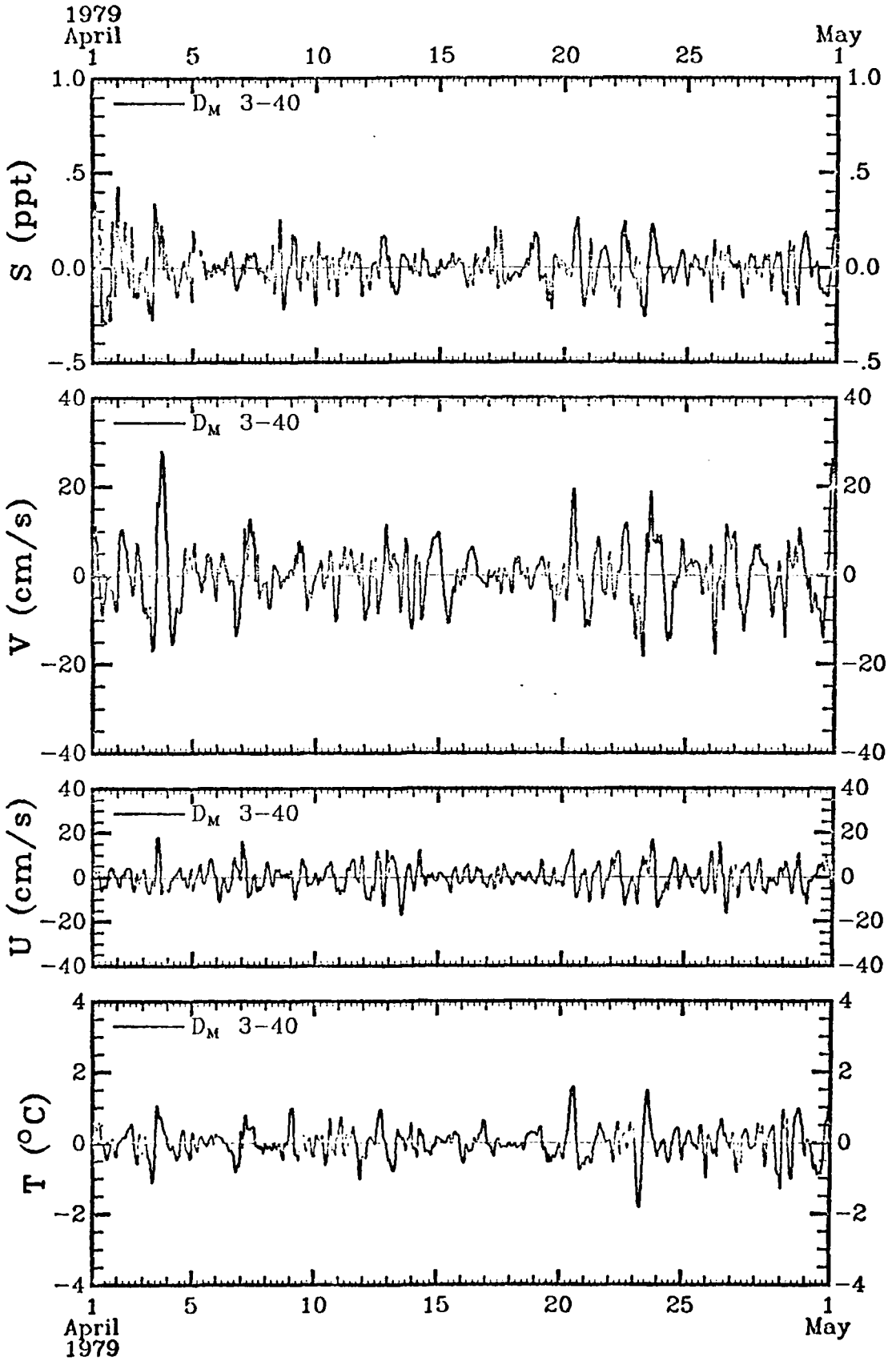

1979
April
May
1
5
10
15
20
25
1
S (ppt)
.4
.2
0.0
-.2
-.4
D_T 3-40
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
2
1
0
-1
-2
D_T 3-40
1
April
1979
Date/Time

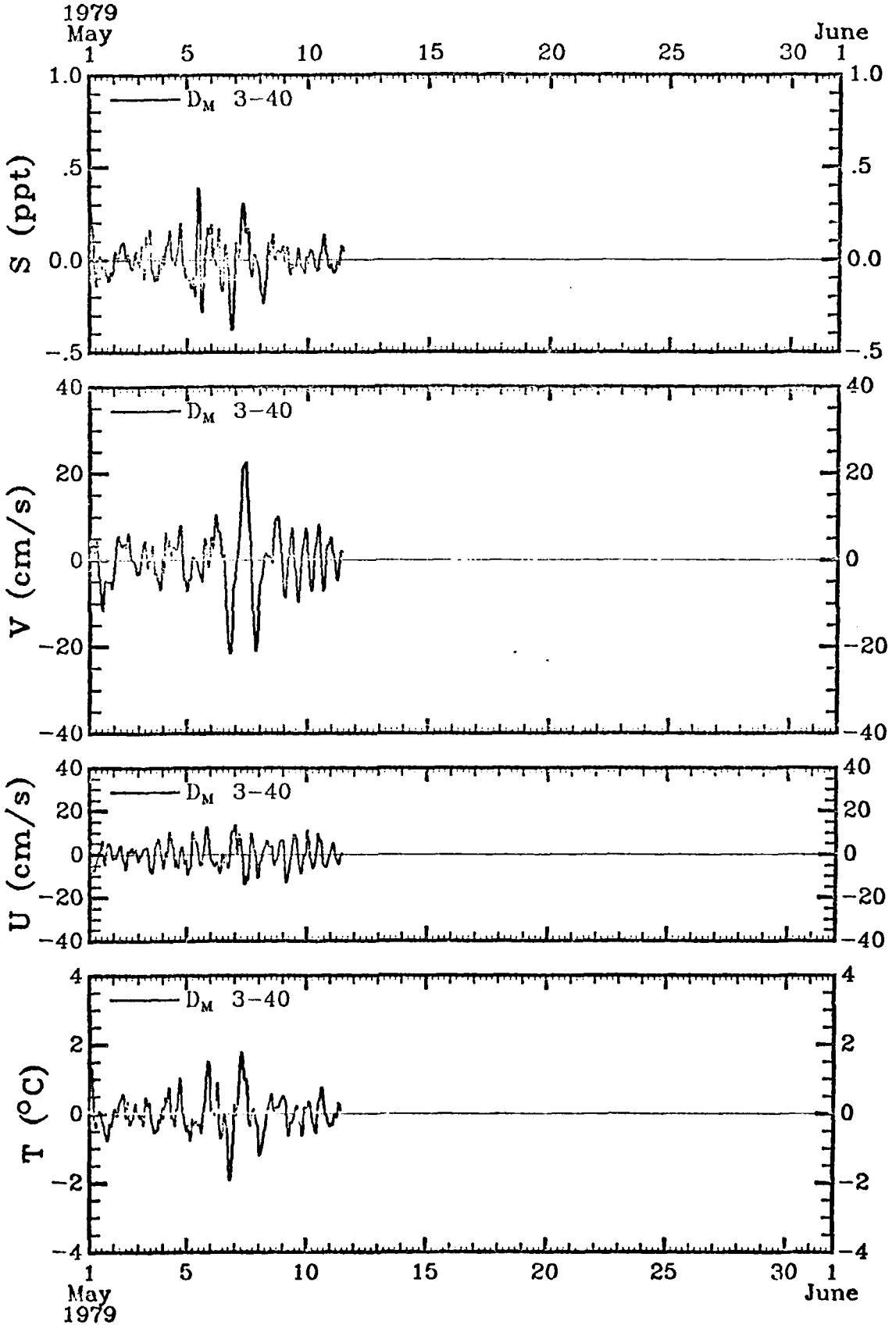

1979
May
June
1
5
10
15
20
25
30
1
D_T 3–40
S (ppt)
.4
.2
0.0
-.2
-.4
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
D_T 3–40
T (°C)
2
1
0
-1
-2
1
May
1979
June
Date/Time

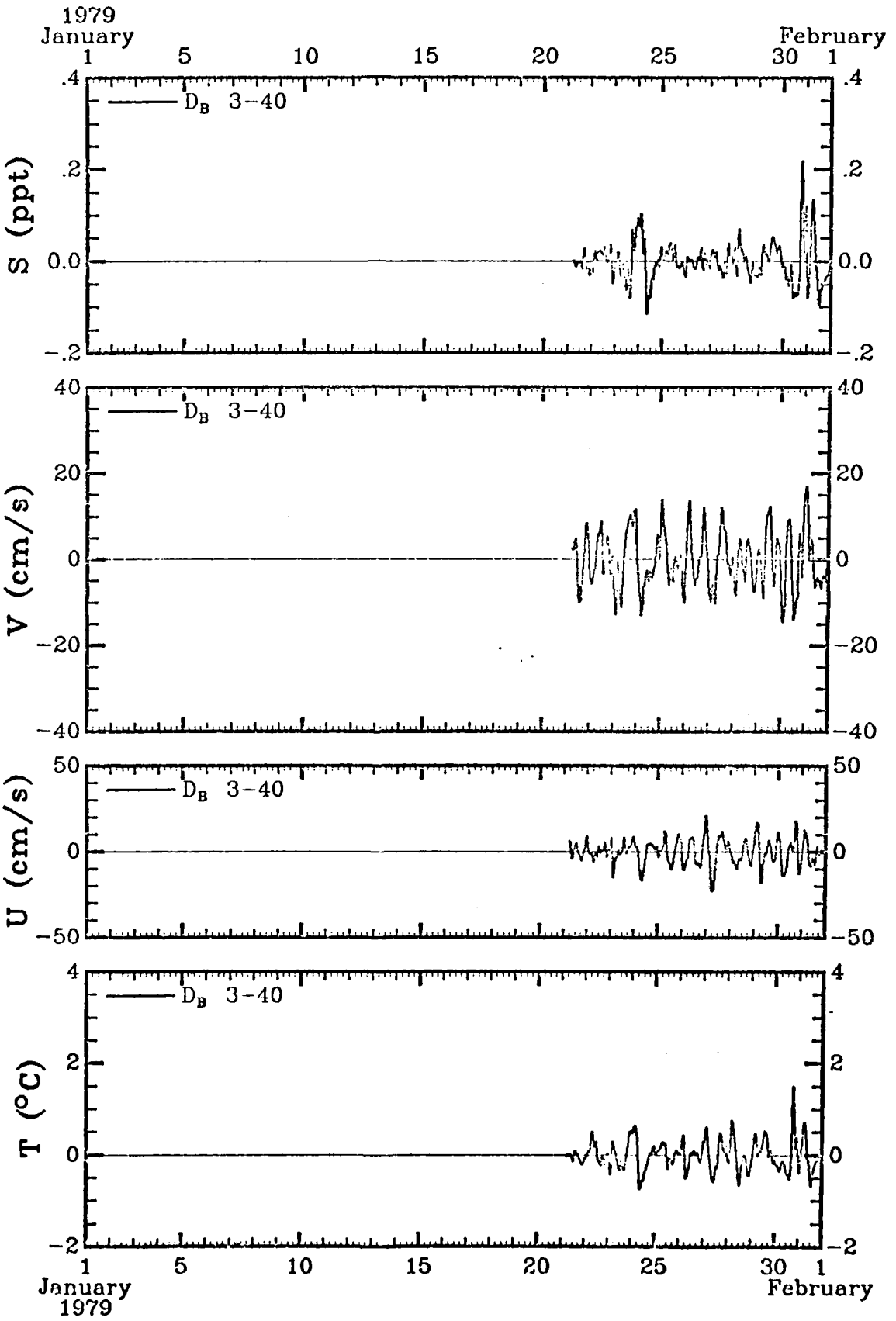

1979
January
February
1 5 10 15 20 25 30 1
D_M 3–40
S (ppt)
1.0
.5
0.0
–.5
V (cm/s)
40
20
0
–20
–40
U (cm/s)
T (°C)
4
2
–2
–4
January
1979
Date/Time

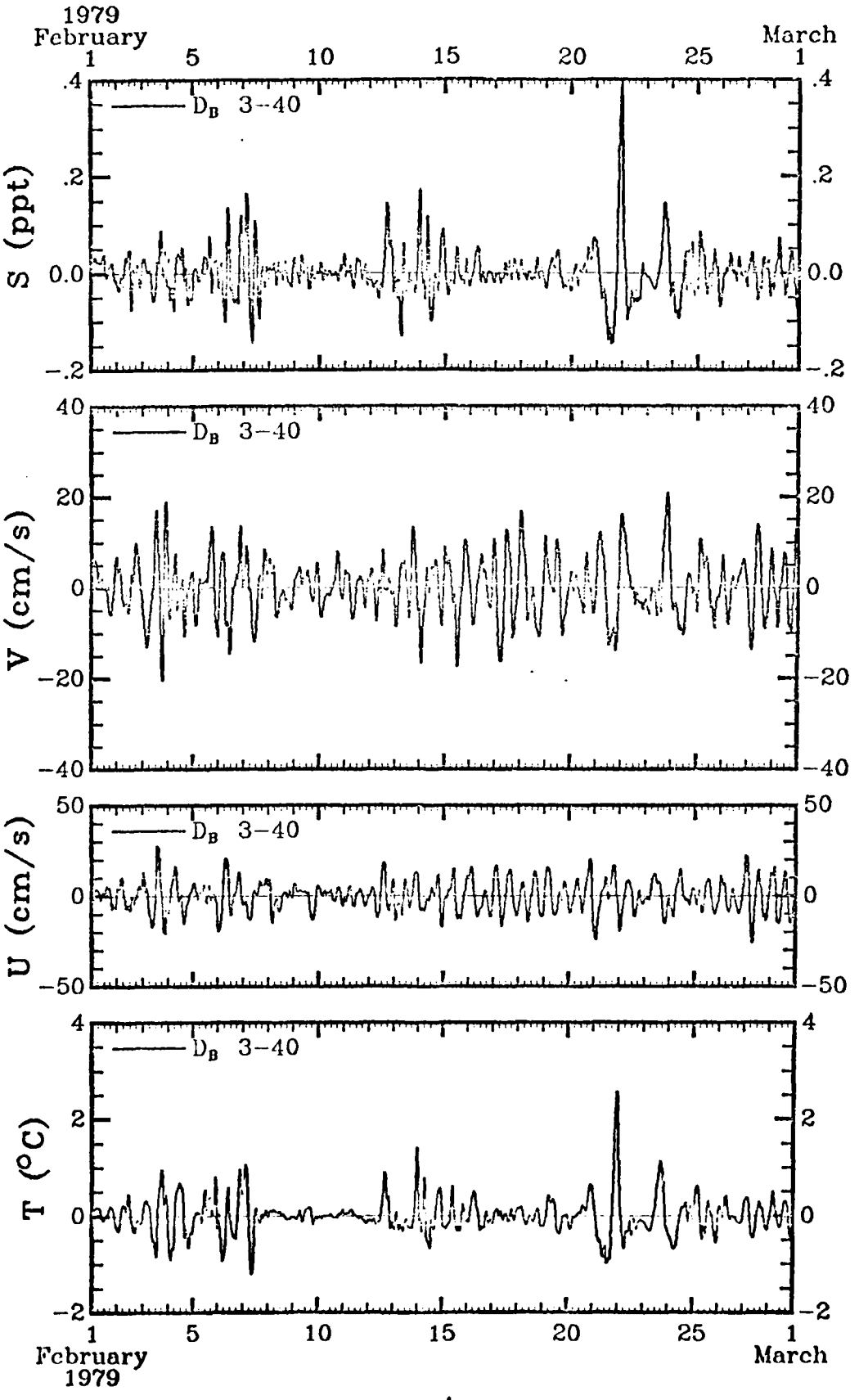

1979
February
March
1
5
10
15
20
25
1
D_M 3–40
S (ppt)
1.0
.5
0.0
–.5
V (cm/s)
40
20
0
–20
–40
U (cm/s)
T (°C)
4
2
0
–2
–4
February
1979
March
Date/Time

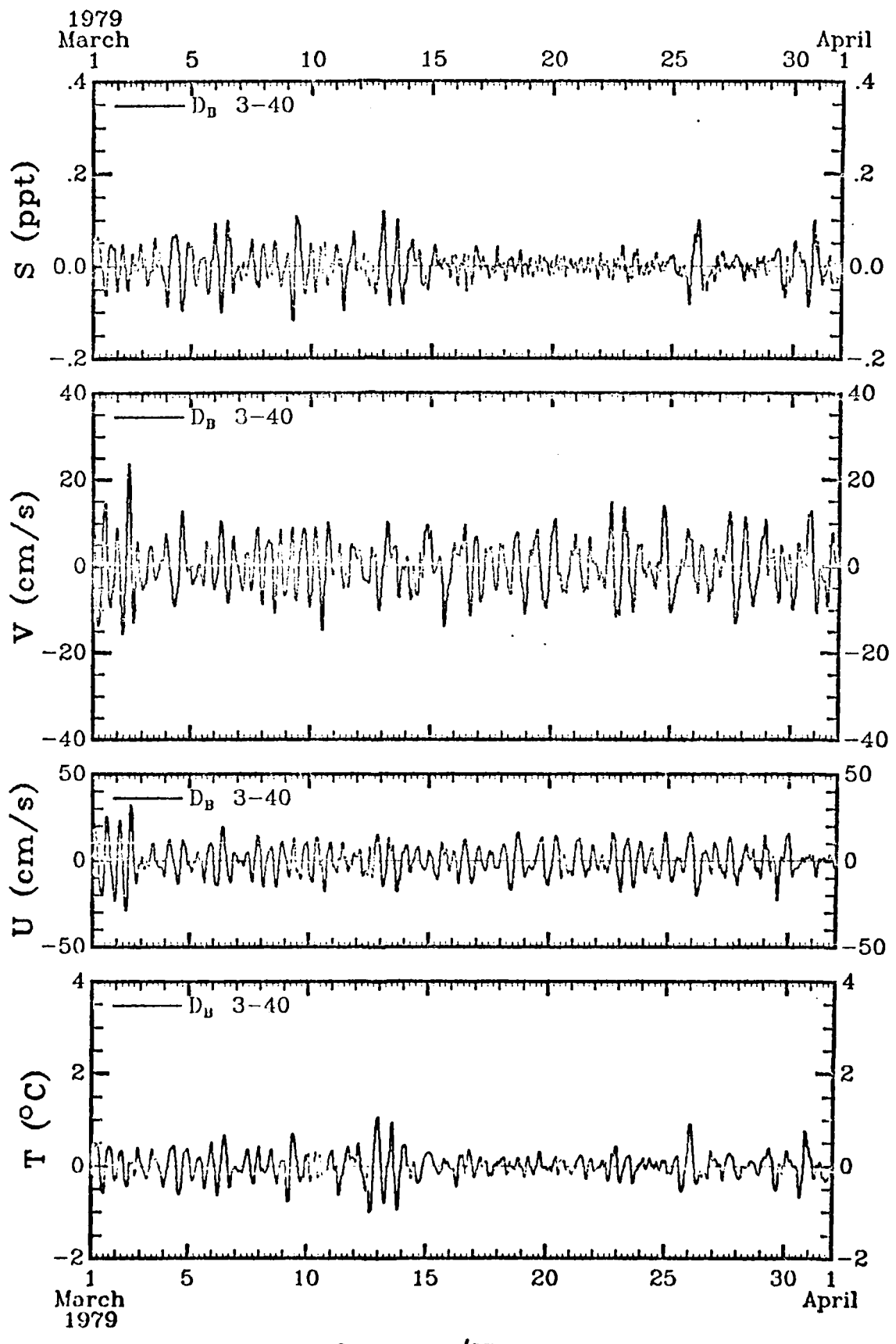

1979
March
April
1
5
10
15
20
25
30
1
1.0
.5
0.0
−.5
D_M 3−40
S (ppt)
40
20
0
−20
−40
V (cm/s)
U (cm/s)
4
2
0
−2
−4
T (°C)
March
1979
April
Date/Time

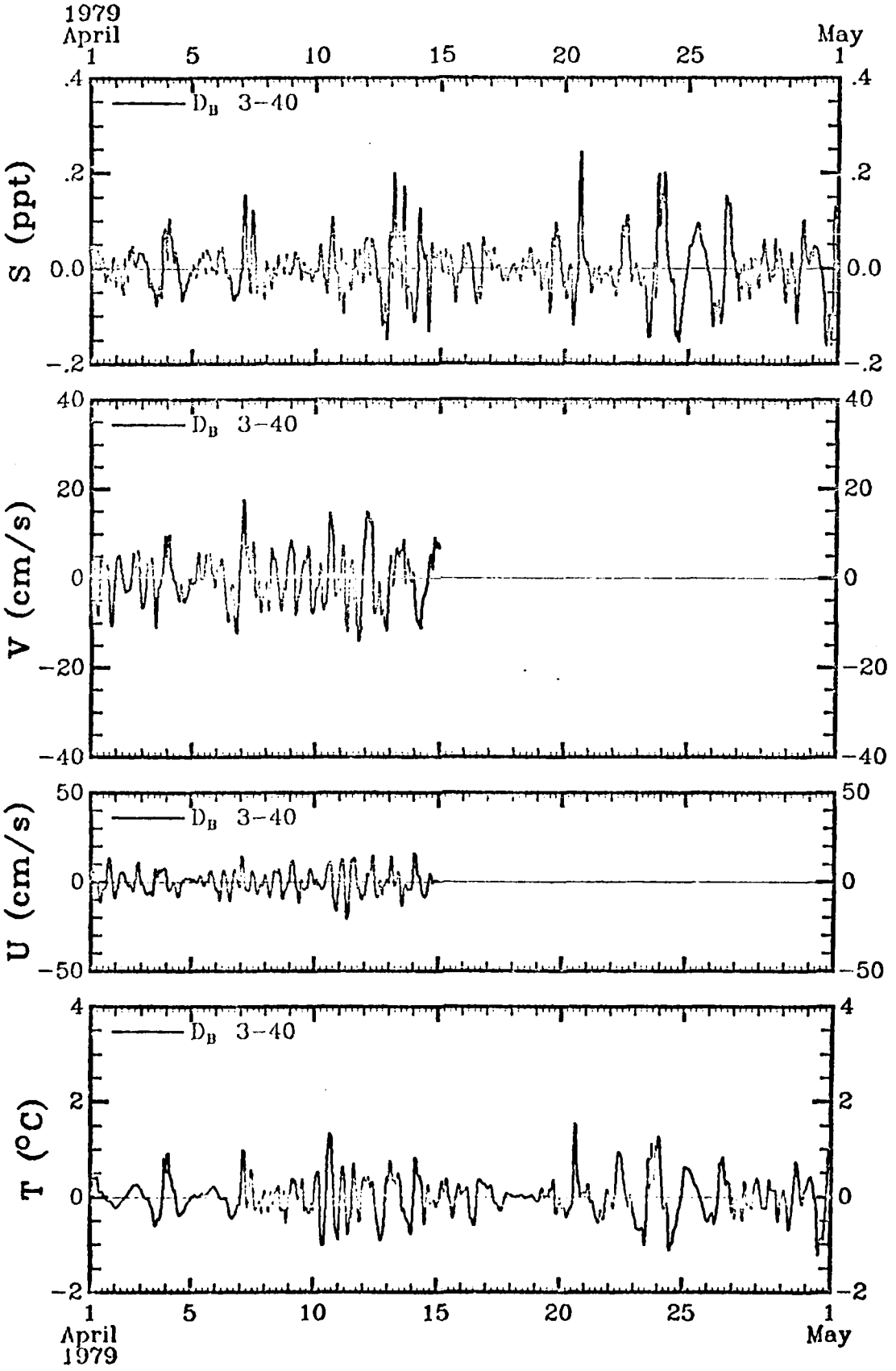

1979
April
May
1
5
10
15
20
25
1
1.0
.5
0.0
−.5
D_M 3–40
S (ppt)
40
20
0
−20
−40
V (cm/s)
U (cm/s)
4
2
0
−2
−4
T (°C)
April
1979
May
Date/Time

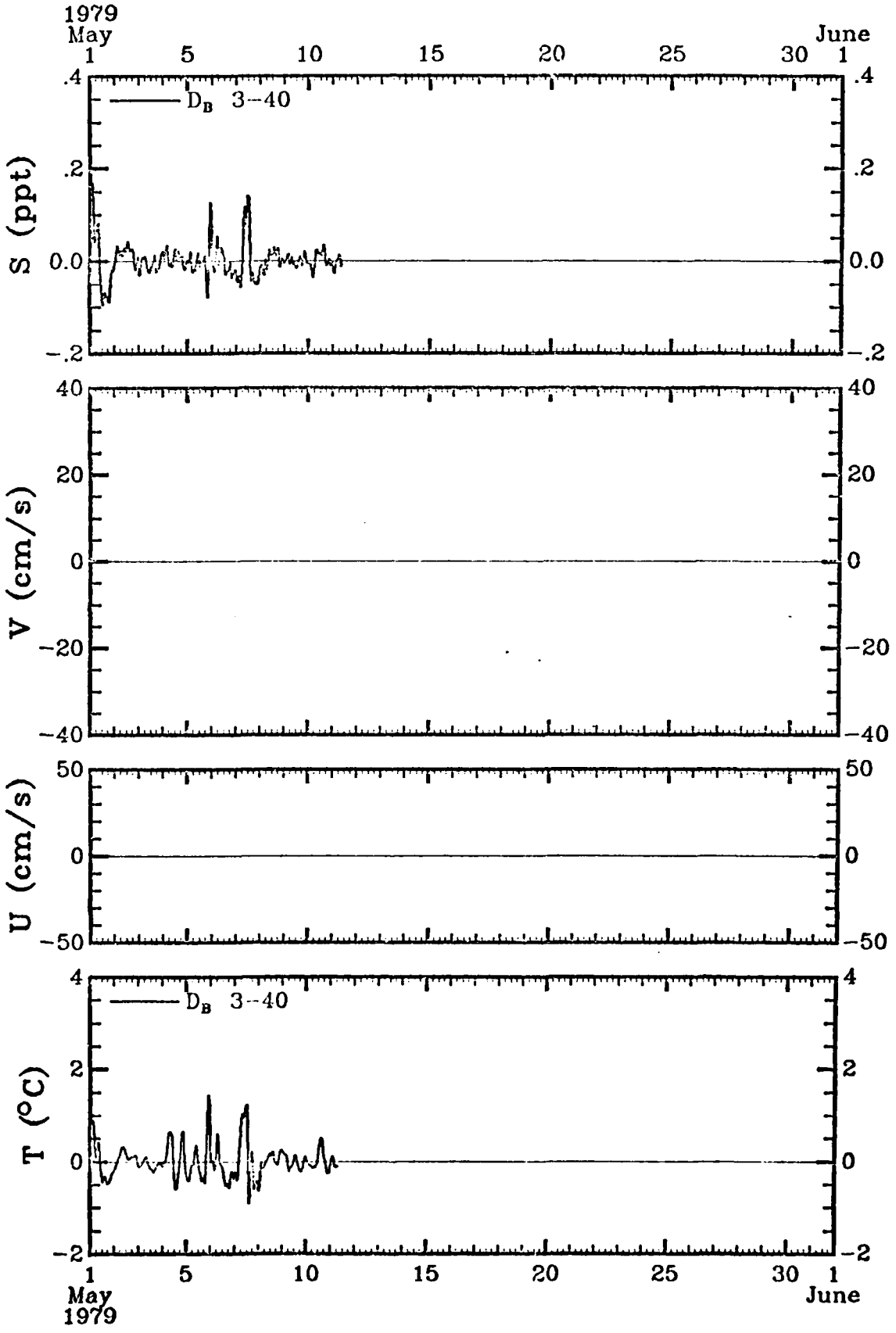

1979
May
June
1
5
10
15
20
25
30
1
1.0
.5
0.0
-.5
D_M 3-40
S (ppt)
40
20
0
-20
-40
V (cm/s)
U (cm/s)
4
2
0
-2
-4
T (°C)
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
D_B 3-40
.4
.2
0.0
-.2
40
20
0
-20
-40
50
-50
4
2
-2
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
S (ppt)
.4
.2
0.0
-.2
D_B 3-40
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
4
2
0
-2
Date/Time


1979
March
April
1
5
10
15
20
25
30
S (ppt)
V (cm/s)
U (cm/s)
T (°C)
D_B 3-40
Date/Time

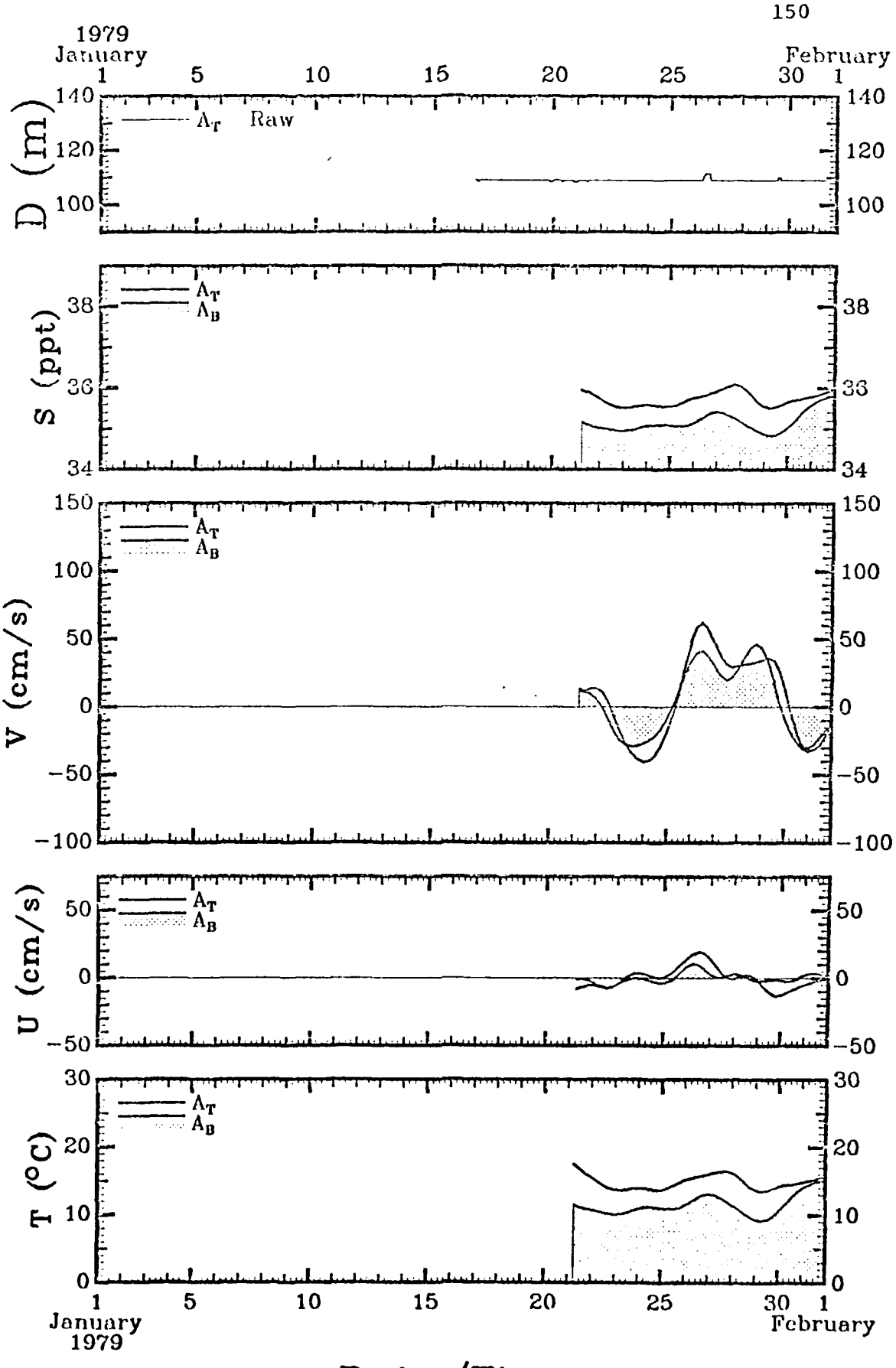

1979
April
1
5
10
15
20
25
May
1
S (ppt)
.4
.2
0.0
-.2
D_B 3-40
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
T (°C)
4
2
0
-2
Date/Time

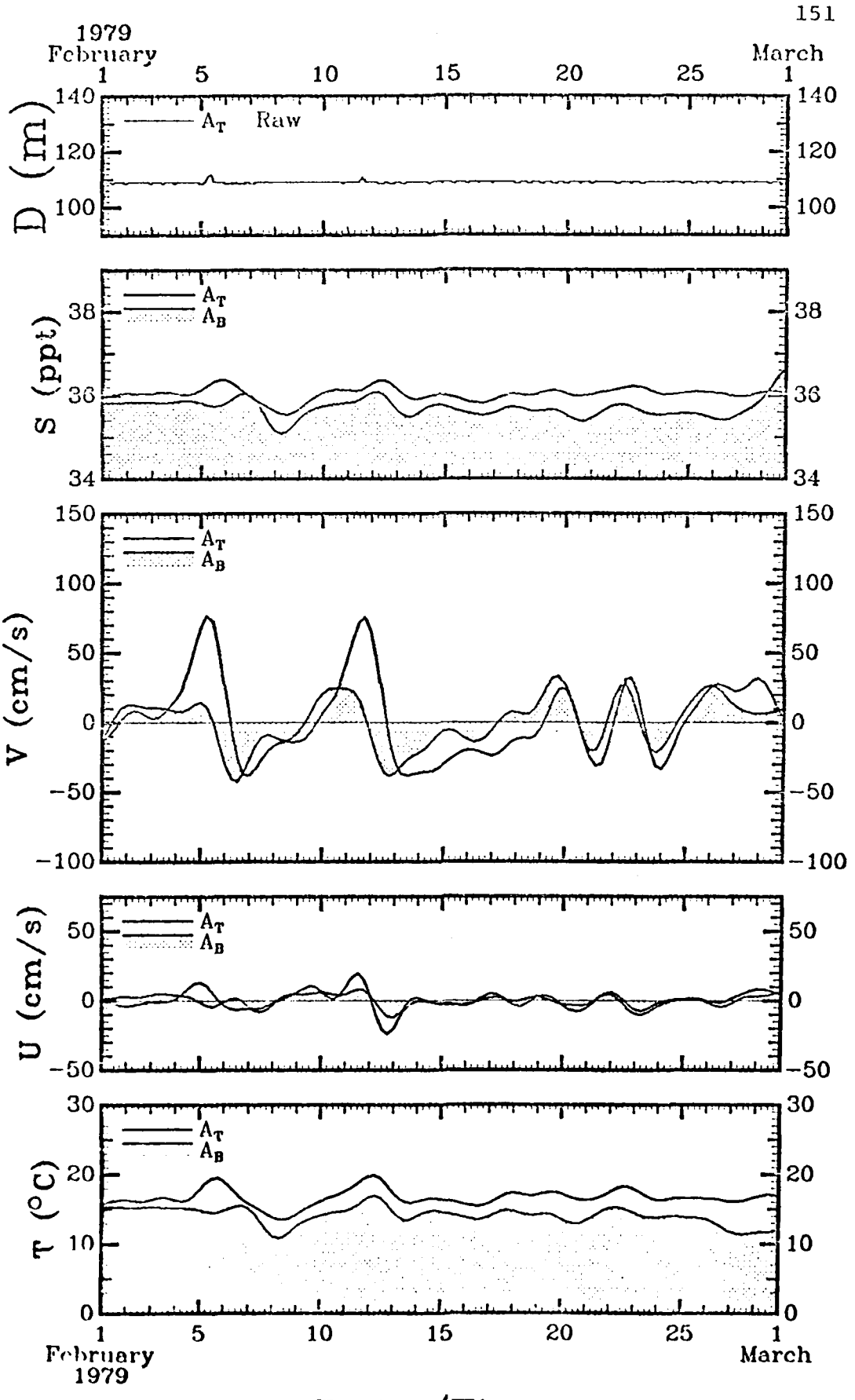

1979
May
June
1
5
10
15
20
25
30
1
D_B 3--40
S (ppt)
.4
.2
0.0
-.2
V (cm/s)
40
20
0
-20
-40
U (cm/s)
50
0
-50
D_B 3--40
T (°C)
4
2
0
-2
May
1979
June
Date/Time

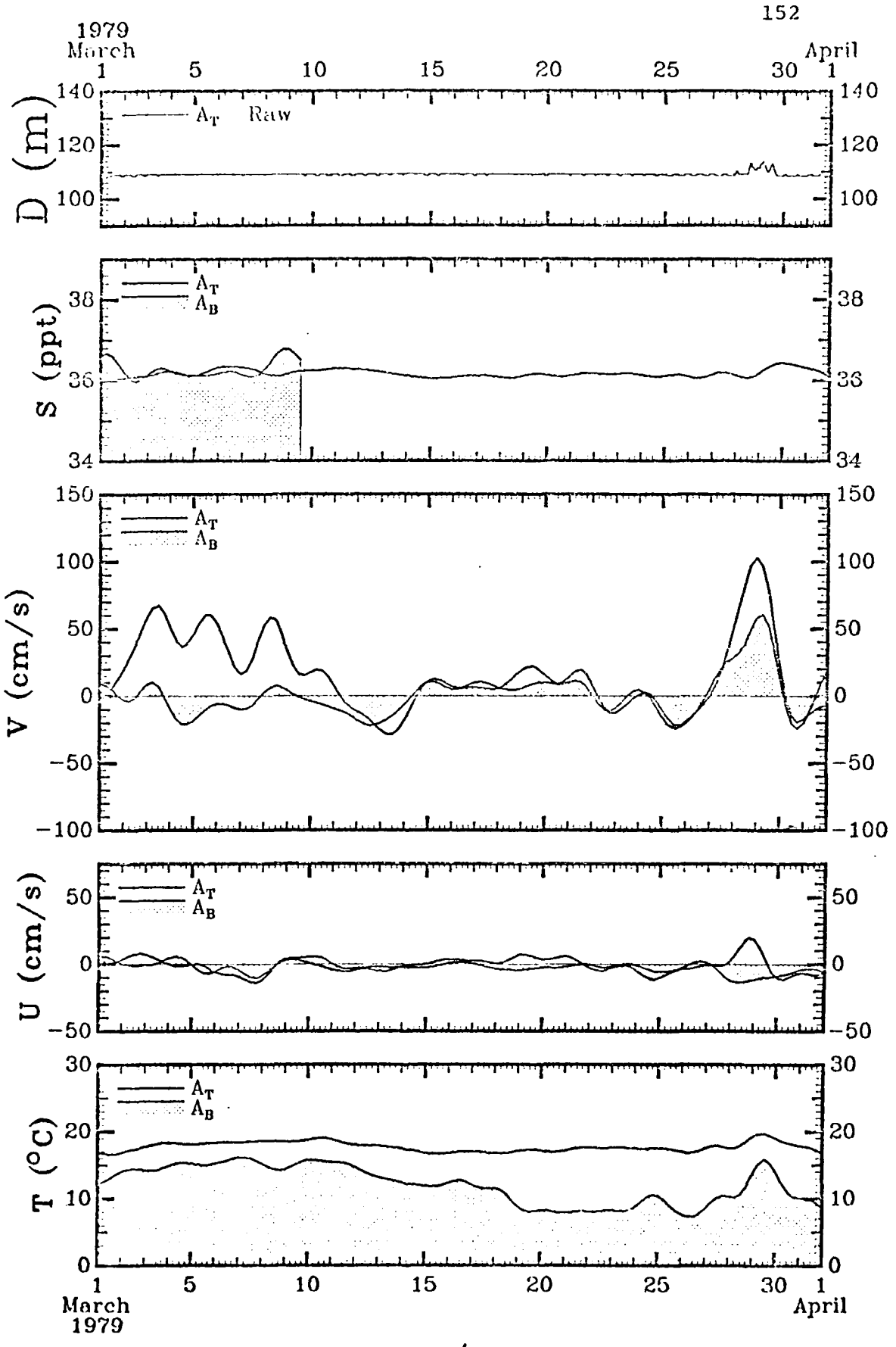
SECTION 5

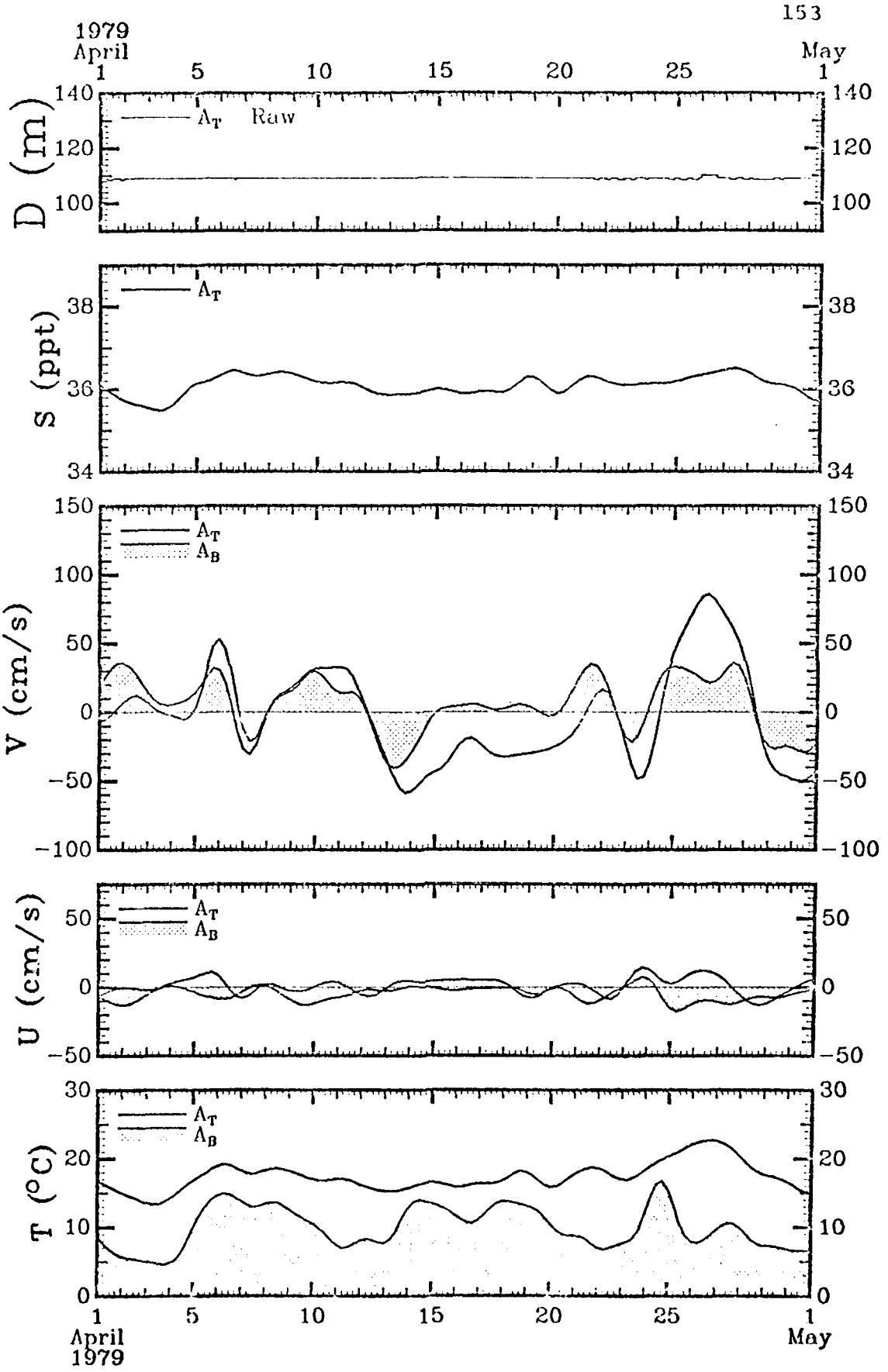
40 HRLP Data for Each Mooring

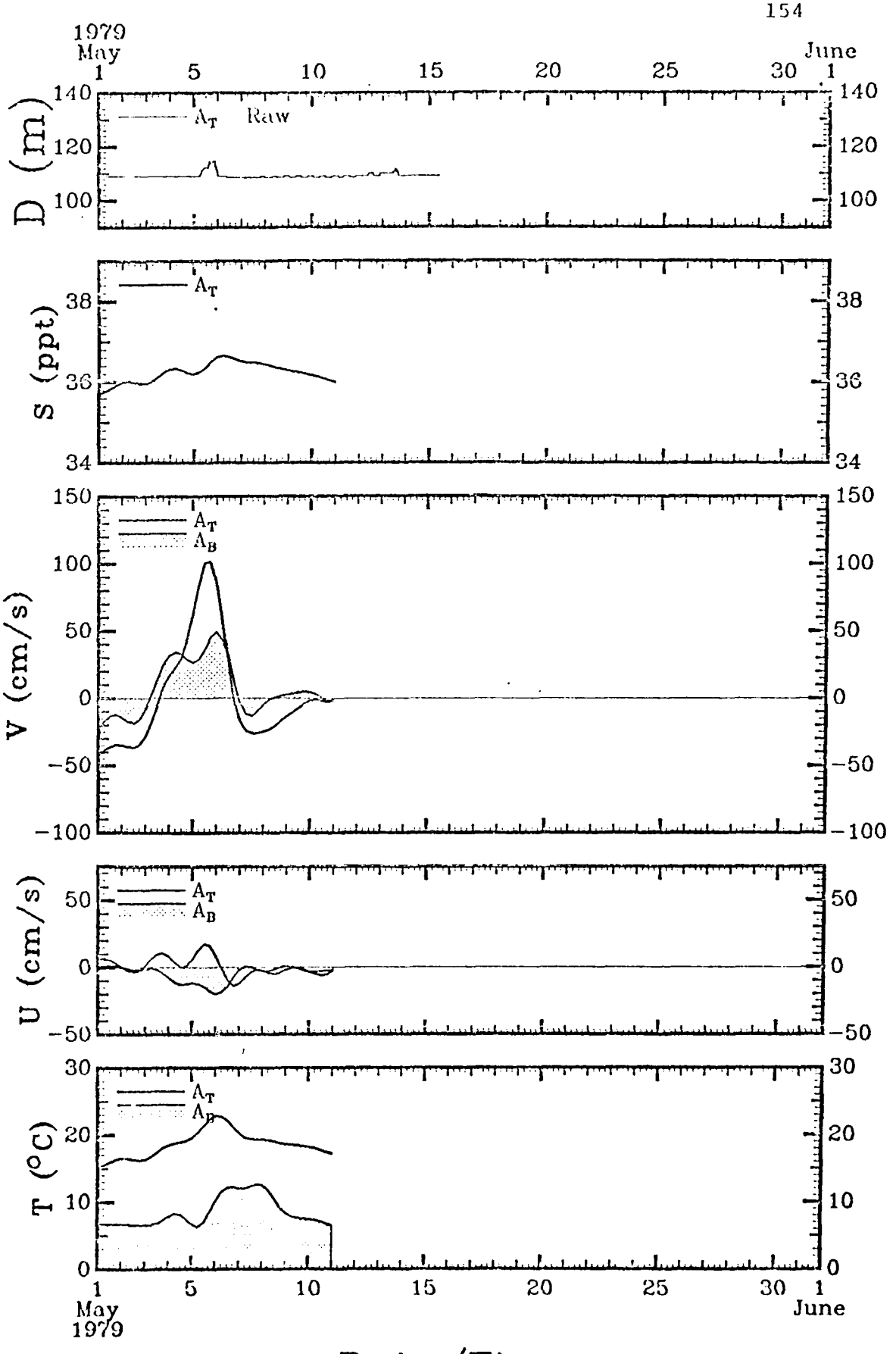
Figures 40 through 43 show the raw pressure data (converted to depth units) and the 40 HRLP current meter data by month for each mooring, superimposing similar data from each instrument on the mooring. Common scaling is used in this section.

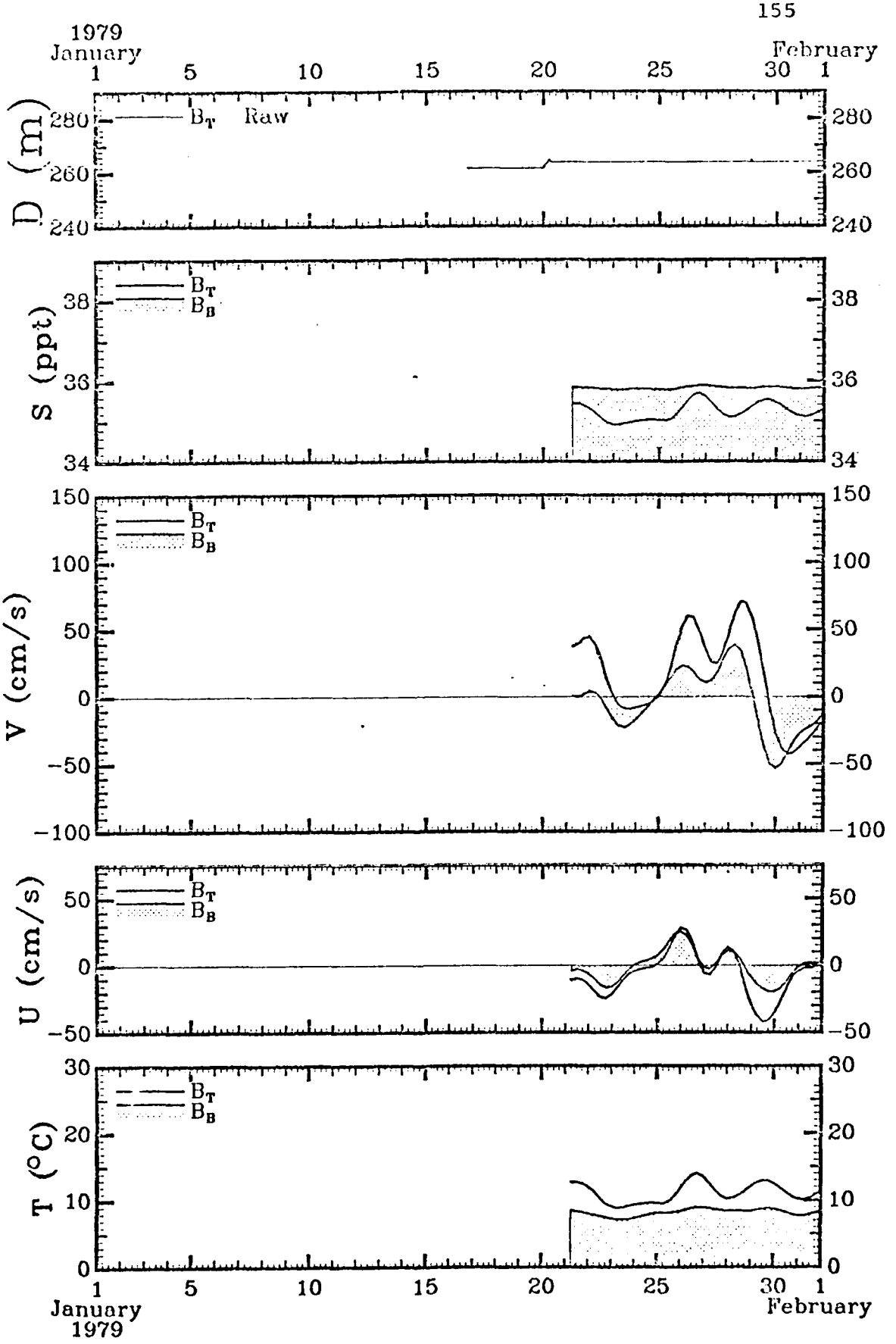

150
1979
January
February
1 5 10 15 20 25 30 1
D (m)
140
120
100
A_T Raw
S (ppt)
38
36
34
A_T
A_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

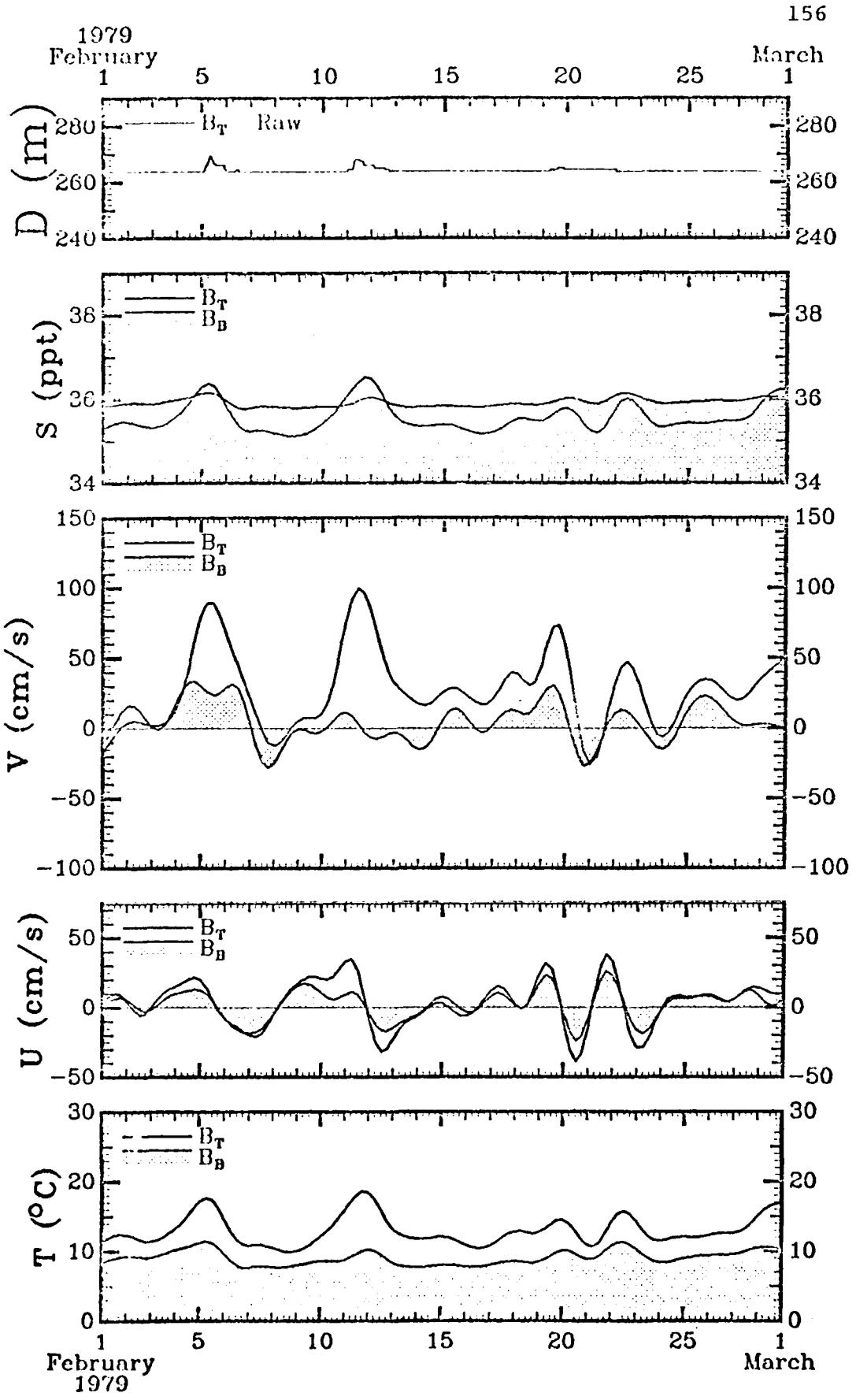

1979
February
March
1
5
10
15
20
25
1
D (m)
140
120
100
A_T Raw
S (ppt)
38
36
34
A_T
A_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
1
February
1979
March
Date/Time

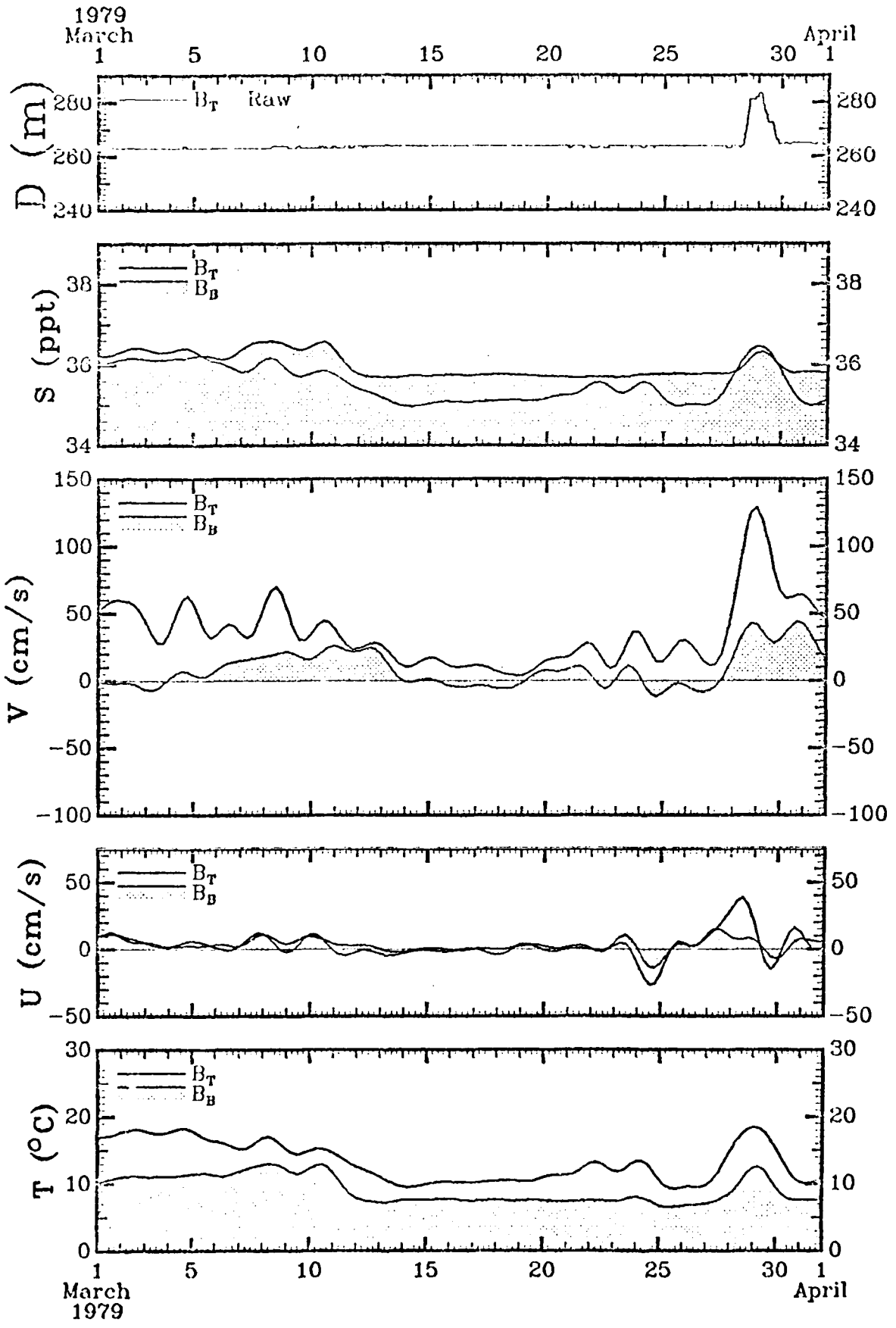

1979
March
April
1 5 10 15 20 25 30 1
D (m)
140
120
100
A_T Raw
S (ppt)
38
36
34
A_T
A_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
April
Date/Time

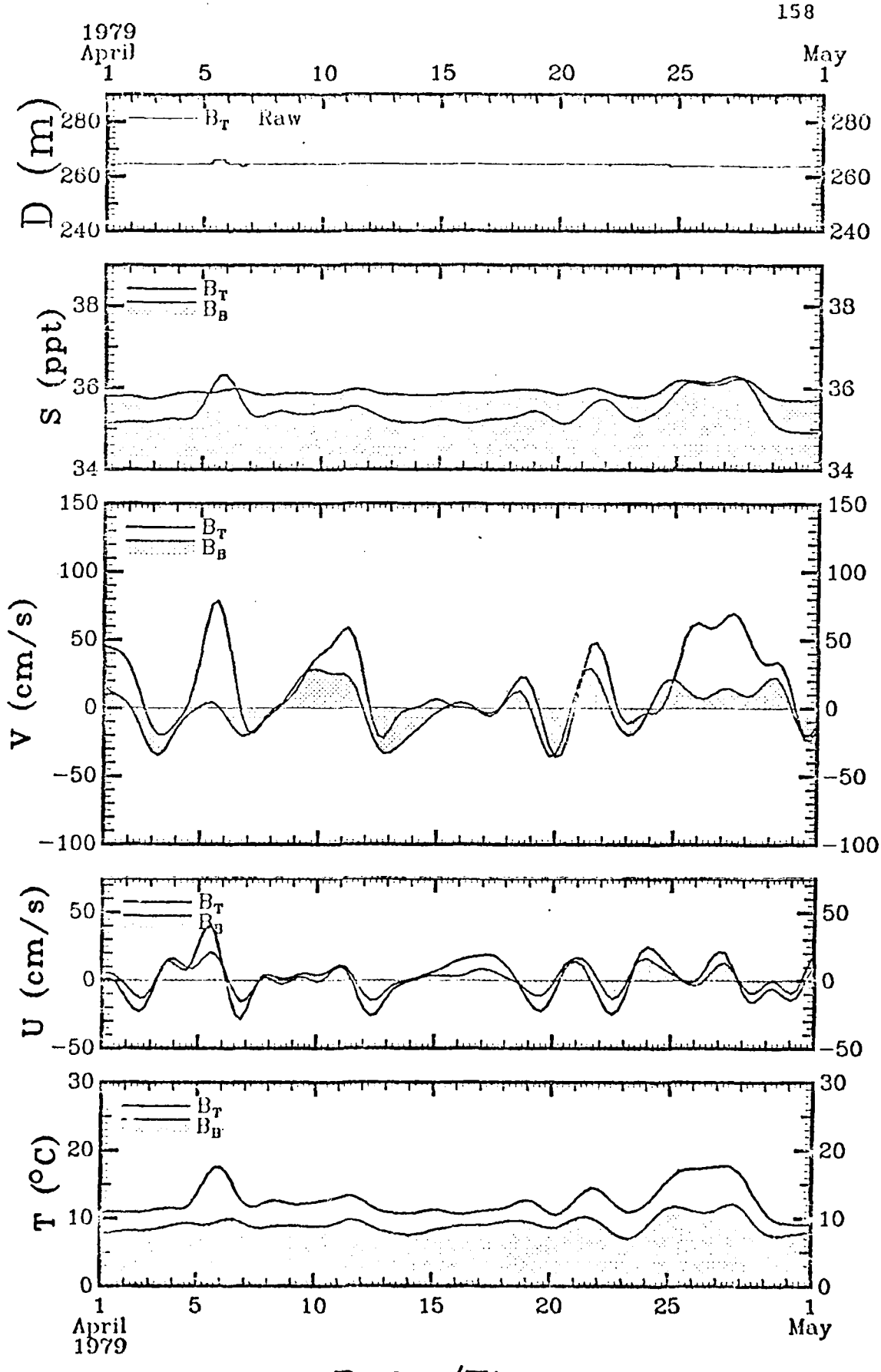

1979
April
May
1
5
10
15
20
25
1
D (m)
140
120
100
A_T Raw
S (ppt)
38
36
34
A_T
V (cm/s)
150
100
50
0
−50
−100
A_T
A_B
U (cm/s)
50
0
−50
A_T
A_B
T (°C)
30
20
10
0
A_T
A_B
Date/Time

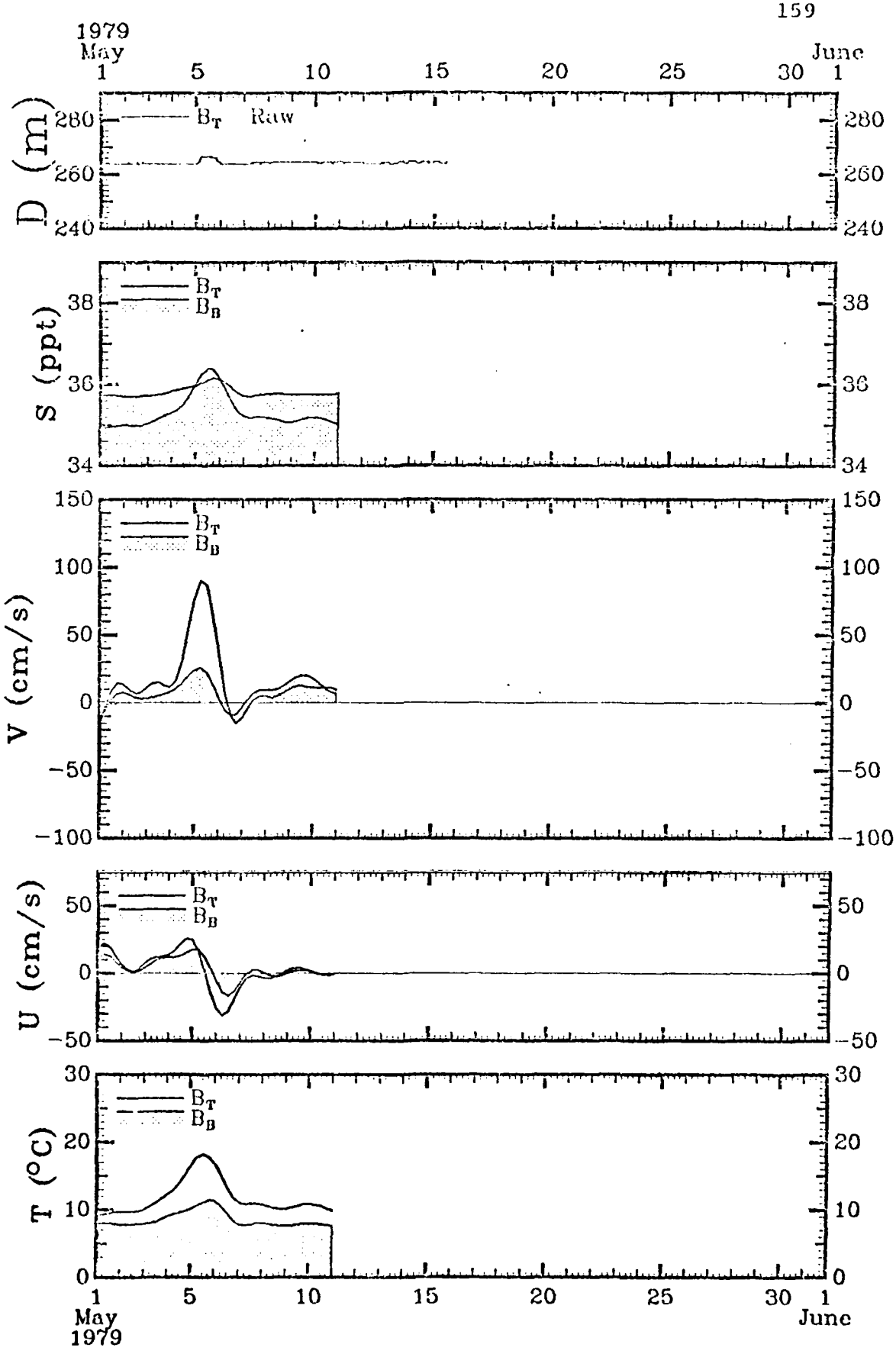

1979
May
June
1
5
10
15
20
25
30
1
D (m)
140
120
100
A_T Raw
S (ppt)
38
36
34
A_T
V (cm/s)
150
100
50
0
−50
−100
A_T
A_B
U (cm/s)
50
0
−50
A_T
A_B
T (°C)
30
20
10
0
A_T
A_B
May
1979
June
Date/Time

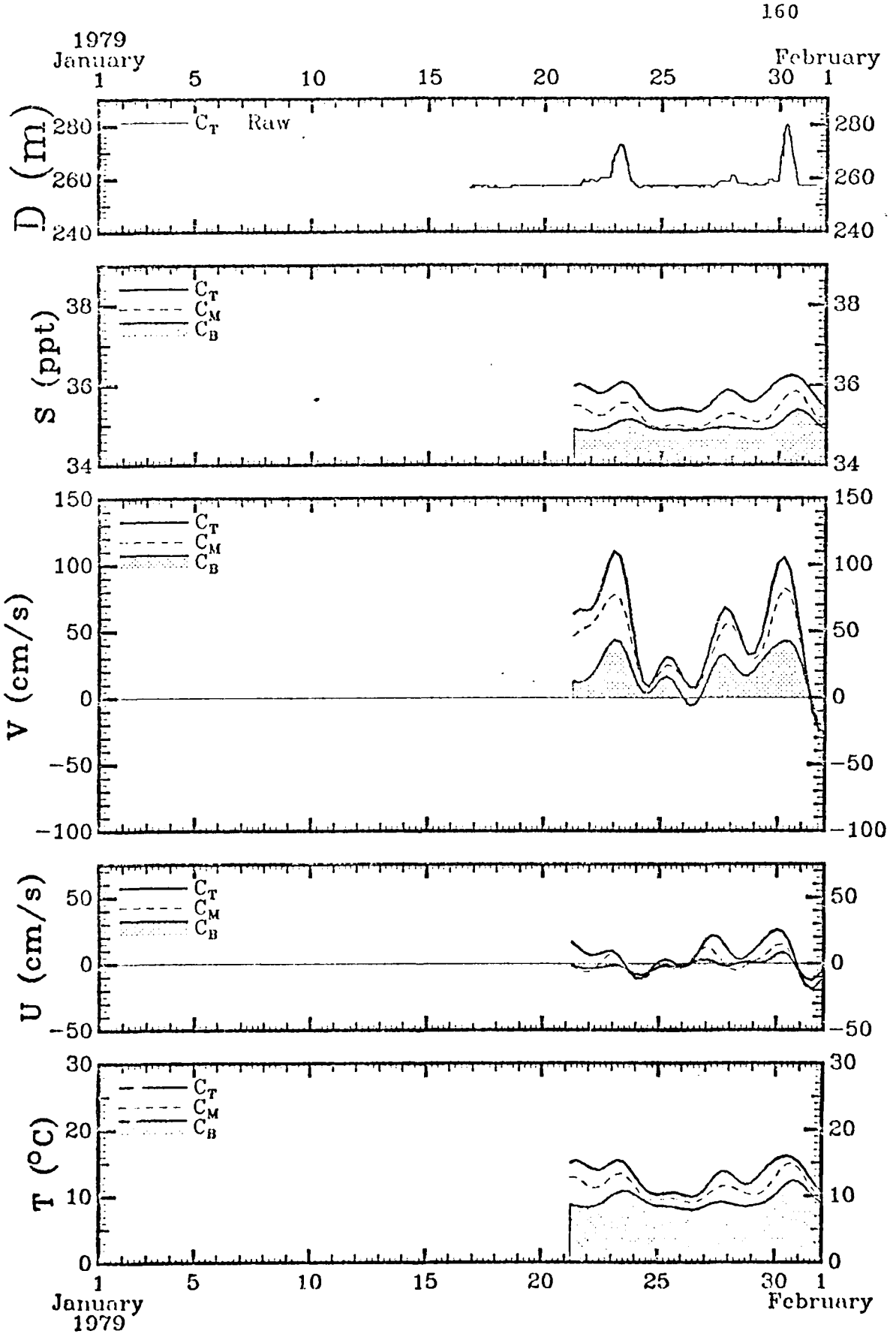

1979
January
February
1 5 10 15 20 25 30 1
D (m)
280
260
240
B_T Raw
S (ppt)
38
36
34
B_T
B_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

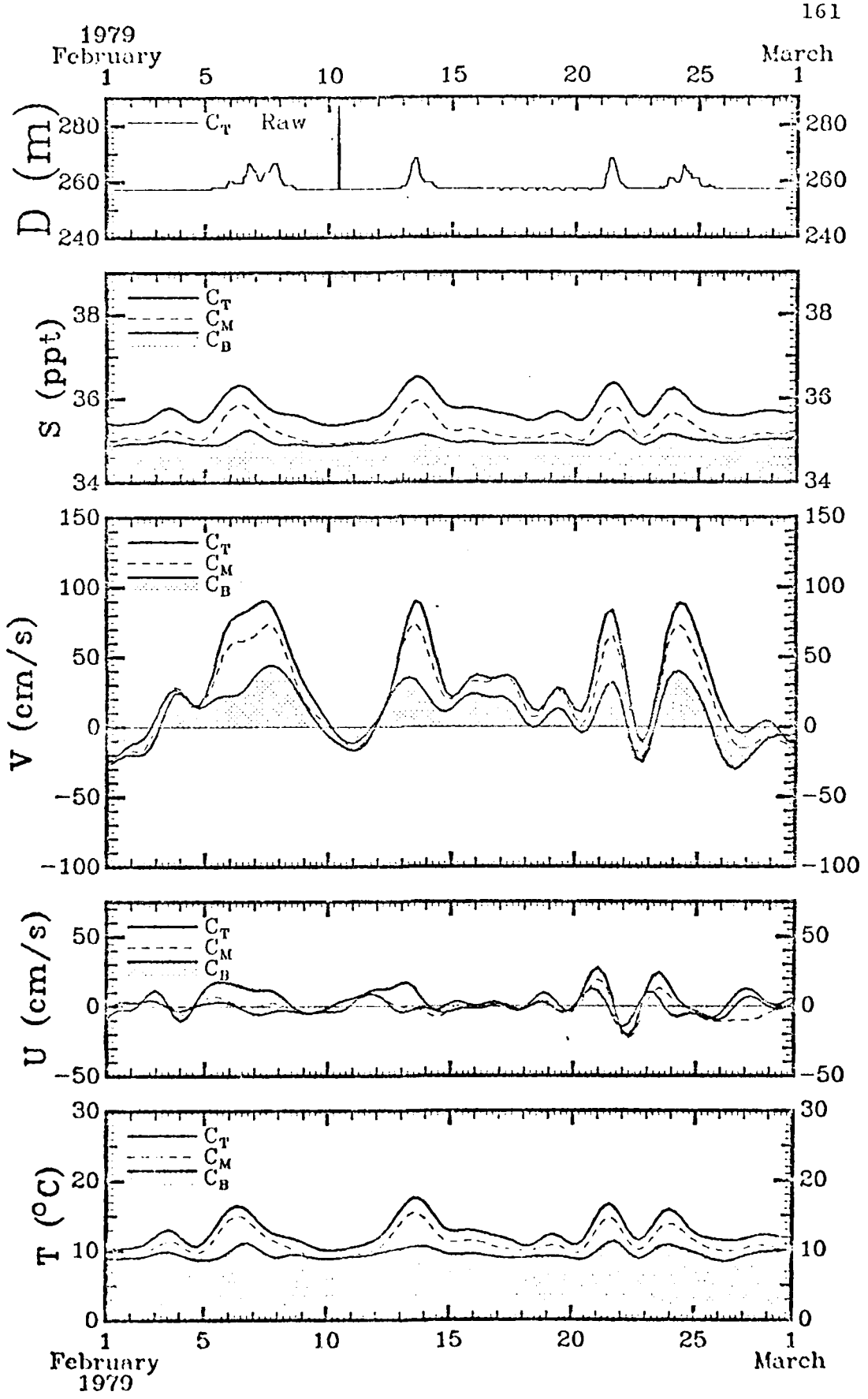

1979
February
March
1
5
10
15
20
25
1
D (m)
280
260
240
B_T Raw
S (ppt)
36
38
34
B_T
B_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
February
1979
March
Date/Time

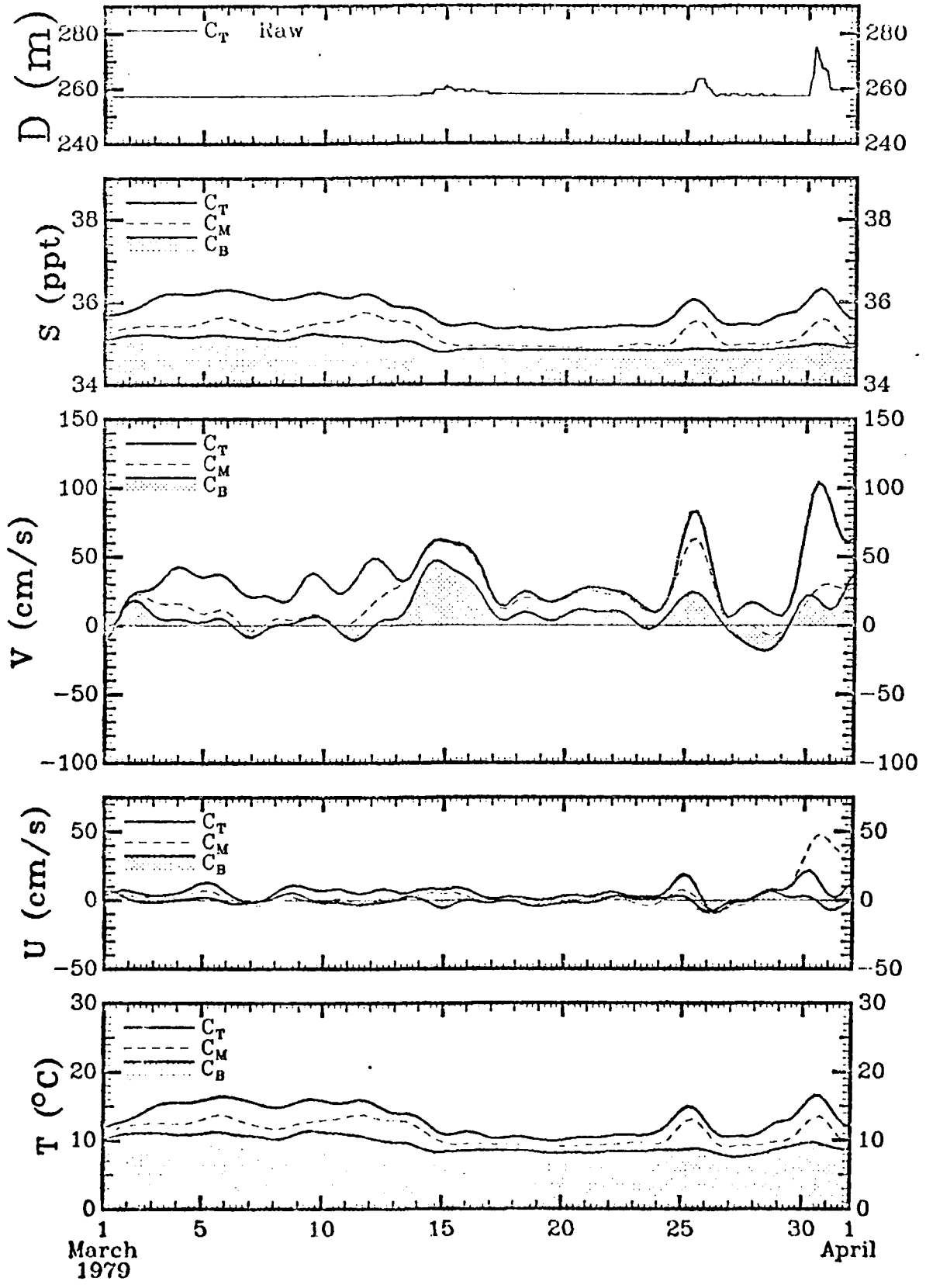

1979
March
April
1
5
10
15
20
25
30
1
D (m)
280
260
240
B_T Raw
S (ppt)
38
36
34
B_T
B_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
March
1979
April
Date/Time

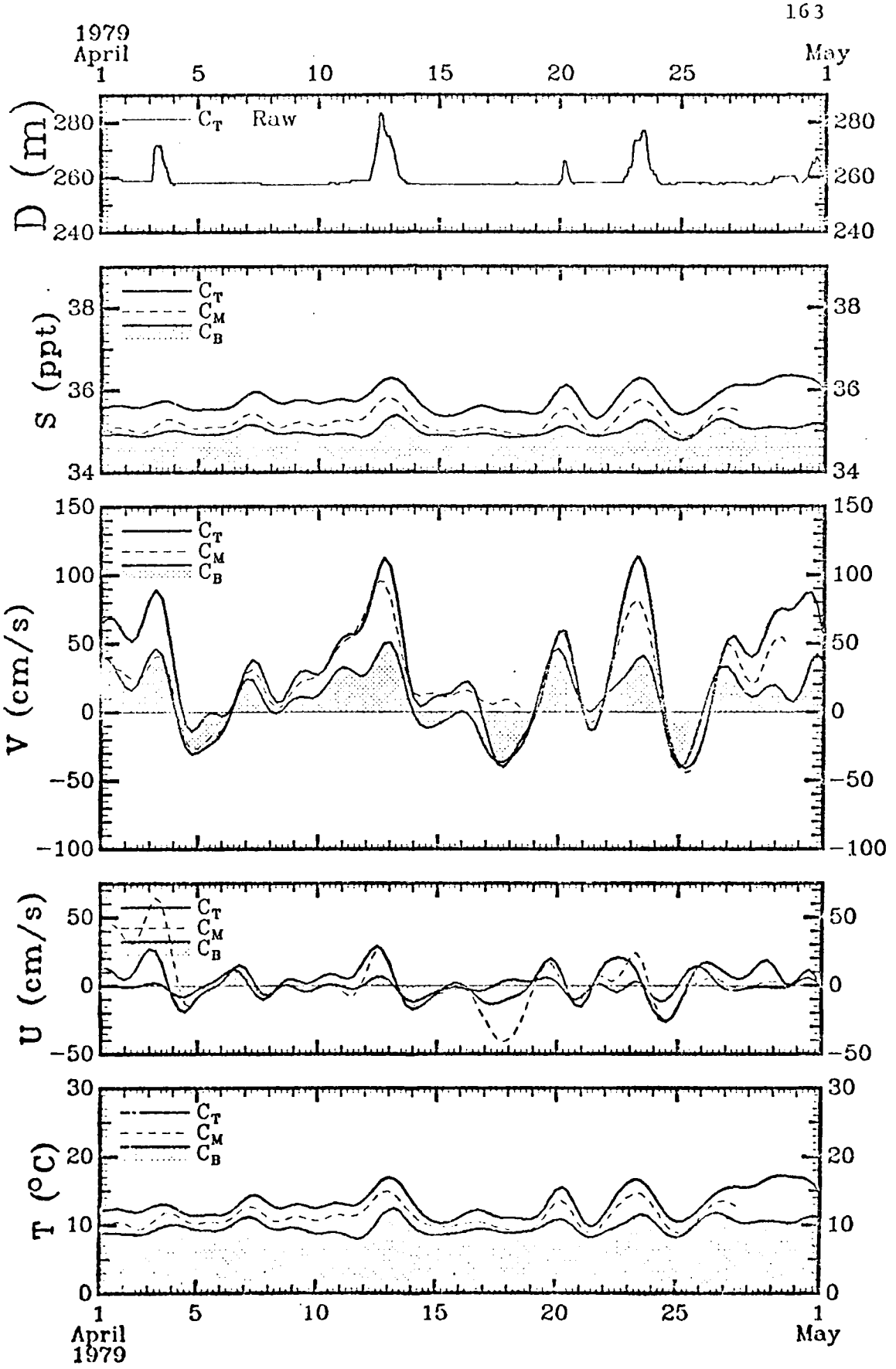

1979
April
May
1
5
10
15
20
25
1
D (m)
280
260
240
B_T Raw
S (ppt)
38
36
34
B_T
B_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
April
1979
May
Date/Time

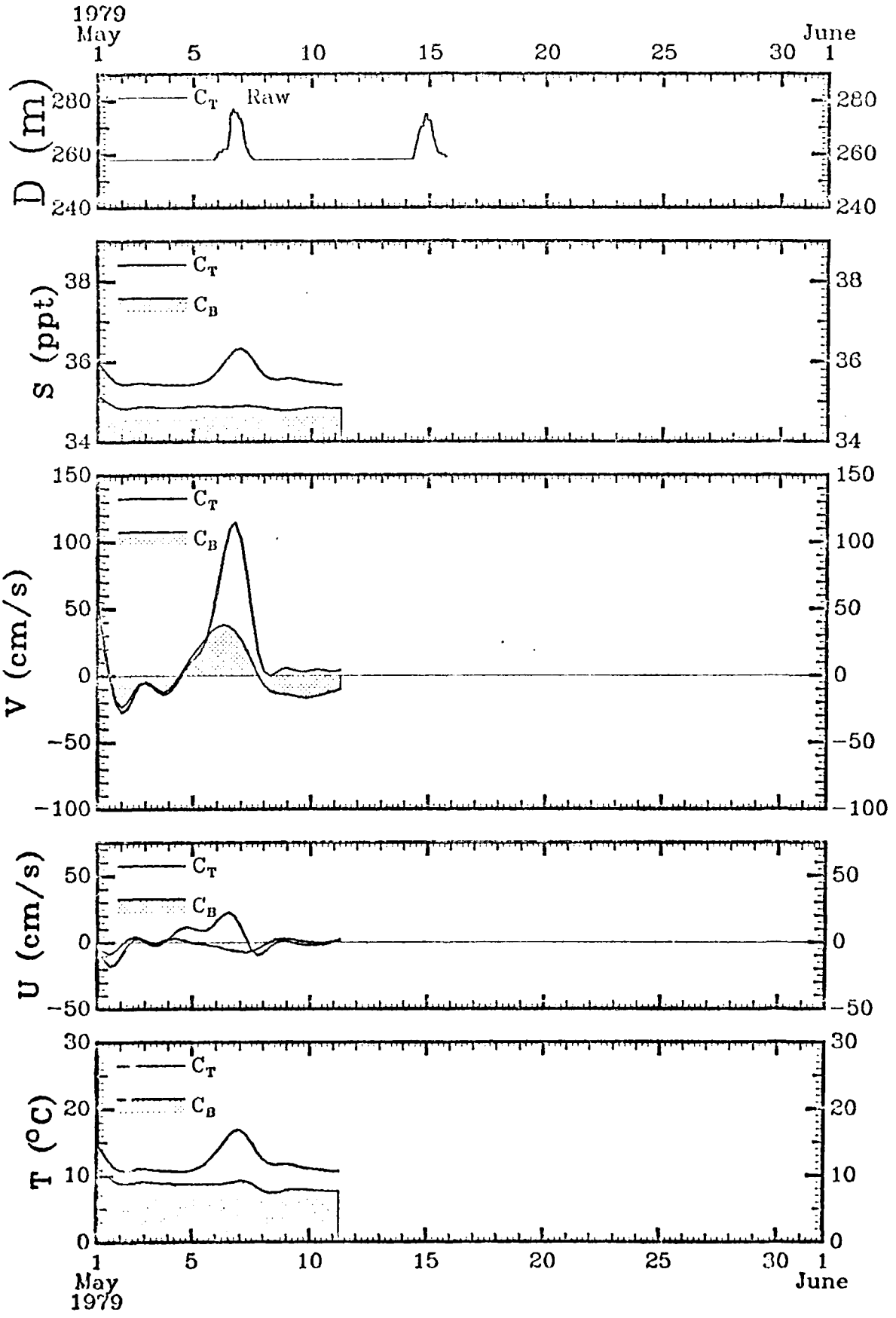

1979
May
June
1
5
10
15
20
25
30
1
D (m)
280
260
240
B_T
Raw
S (ppt)
38
36
34
B_T
B_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
Date/Time

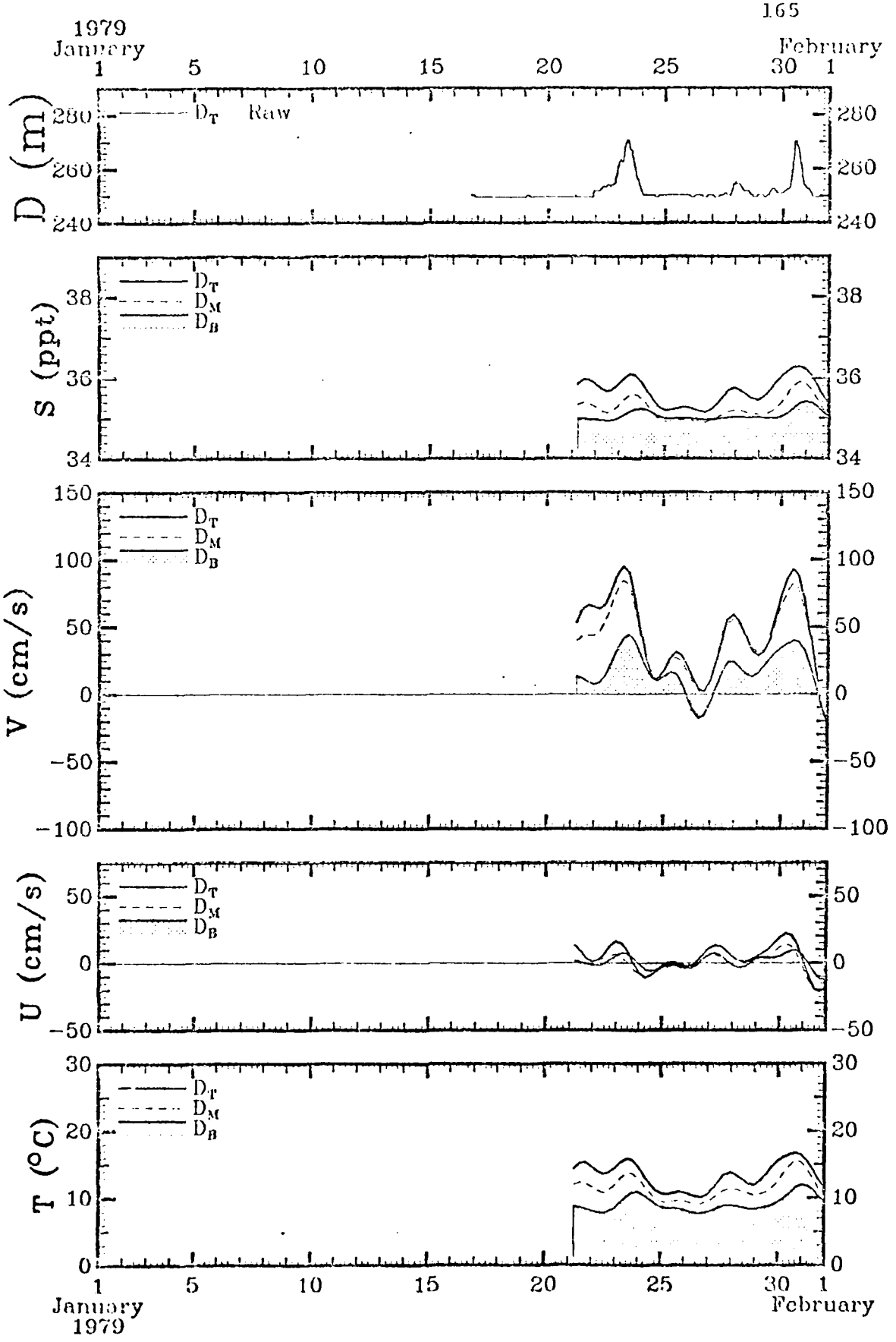

1979
January
February
1 5 10 15 20 25 30 1
D (m)
280
260
240
C_T Raw
S (ppt)
38
36
34
C_T
C_M
C_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time

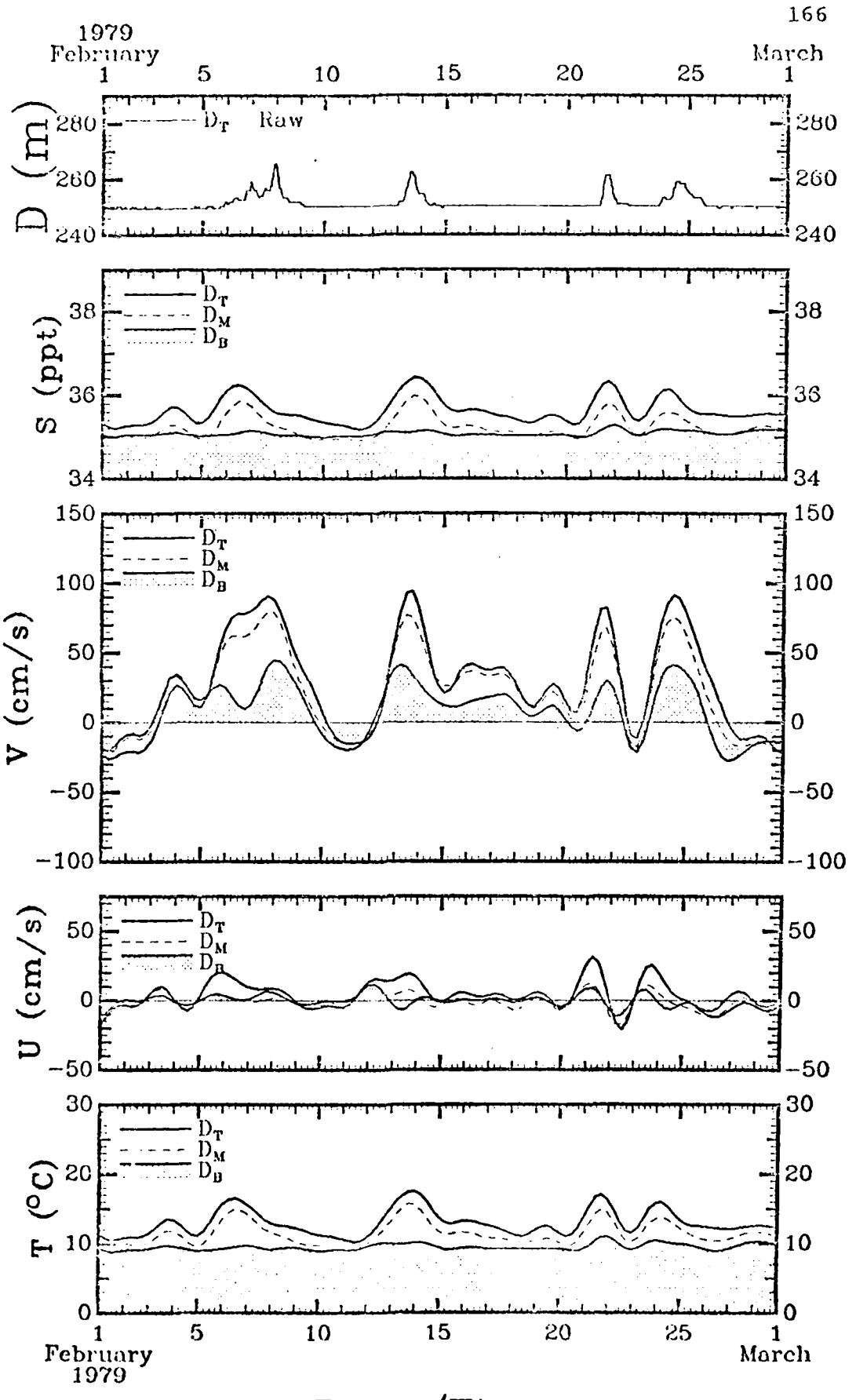

1979
February
March
1
5
10
15
20
25
1
D (m)
280
260
240
C_T Raw
S (ppt)
38
36
34
C_T
C_M
C_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
Date/Time

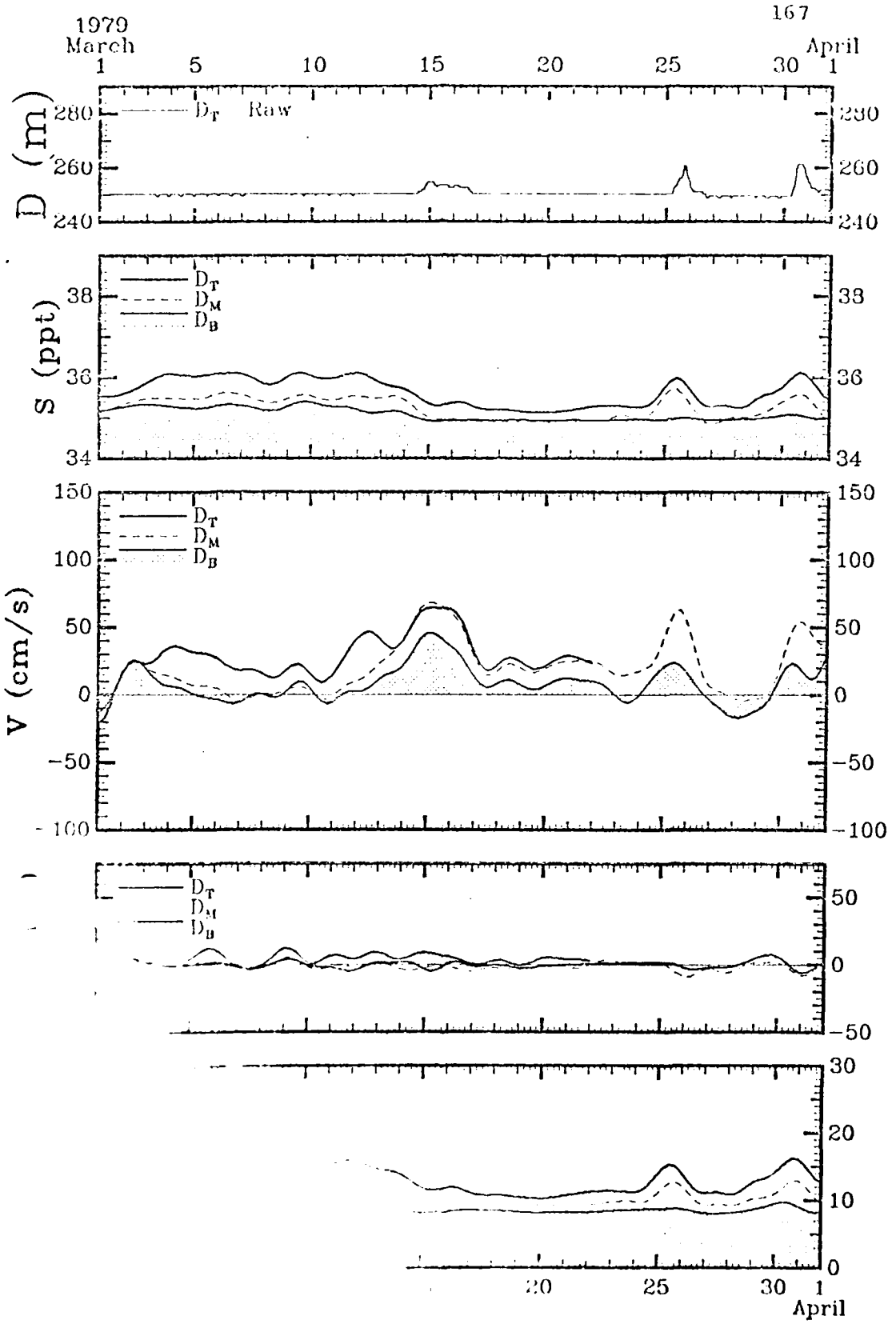

1979
March
1
5
10
15
20
25
30
April
1
D (m)
280
260
240
C_T Raw
S (ppt)
38
36
34
C_T
C_M
C_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
50
0
−50
T (°C)
30
20
10
0
March
1979
April
Date/Time


1979
April
May
1
5
10
15
20
25
1
D (m)
280
260
240
C_T Raw
S (ppt)
38
36
34
C_T
C_M
C_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
April
1979
May
Date/Time

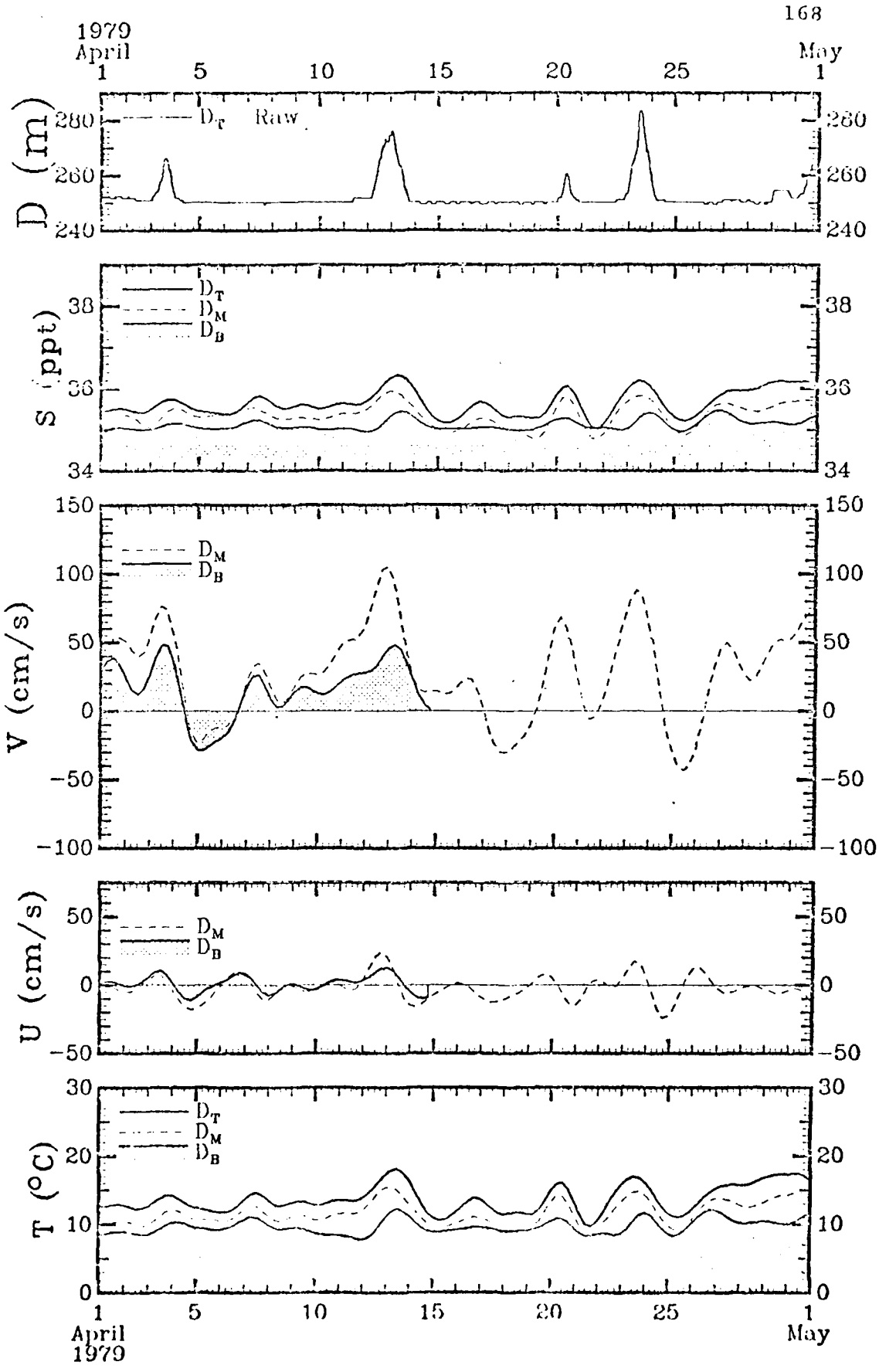

1979
May
June
D (m)
C_T Raw
S (ppt)
C_T
C_B
V (cm/s)
U (cm/s)
T (°C)
Date/Time

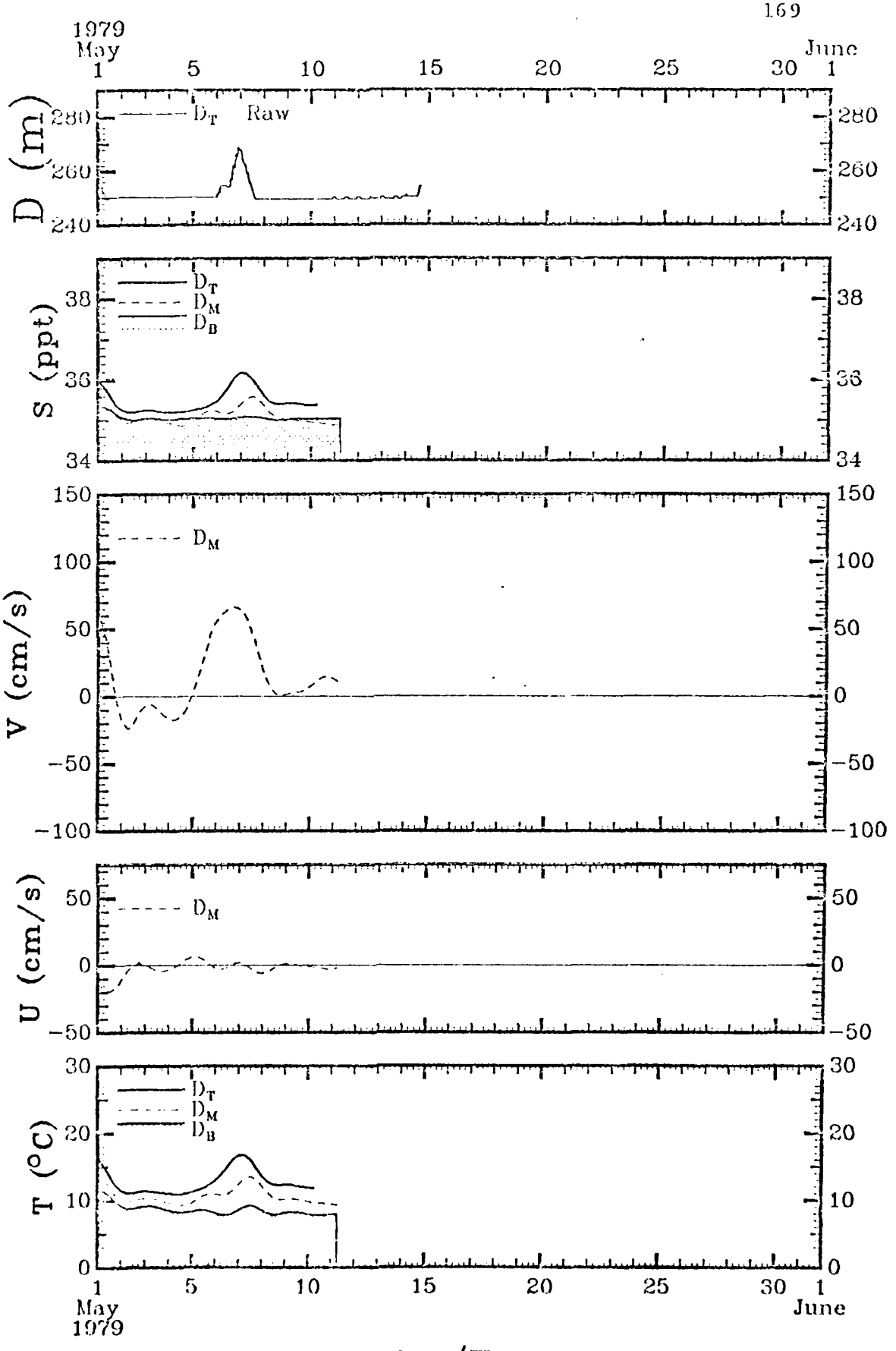

1979
January
February
1 5 10 15 20 25 30 1
D (m)
280
260
240
D_T Raw
S (ppt)
38
36
34
D_T
D_M
D_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
D (m)
280
260
240
D_T Raw
S (ppt)
38
36
34
D_T
D_M
D_B
V (cm/s)
150
100
50
0
−50
−100
U (cm/s)
T (°C)
30
20
10
0
February
1979
March
Date/Time


1979
March
April
1
5
10
15
20
25
30
1
D (m)
280
260
240
D_T Raw
S (ppt)
38
36
34
D_T
D_M
D_B
V (cm/s)
150
100
50
0
−50
−100
20
25
30
1
April

Time

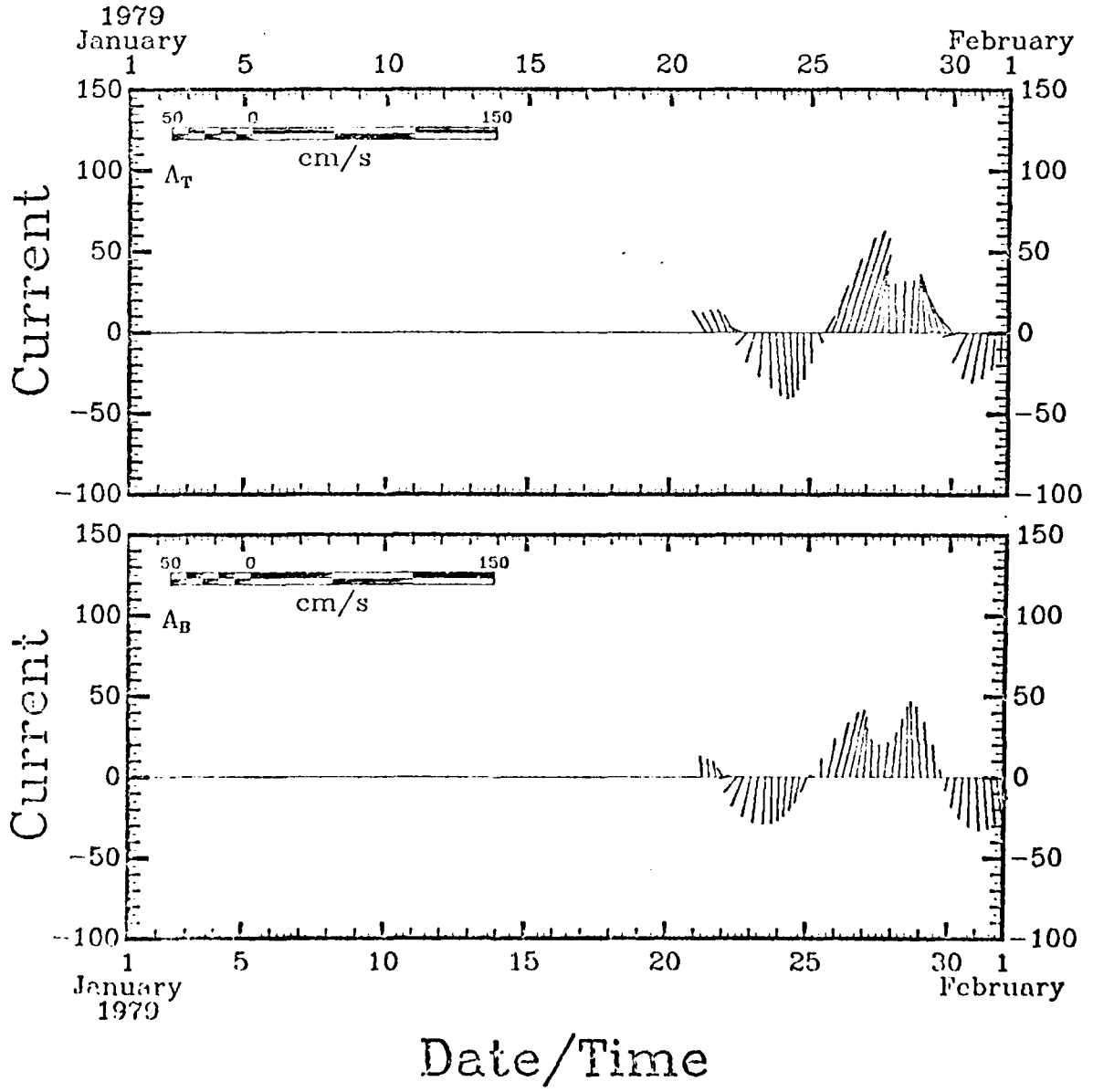

1979
April
May
1
5
10
15
20
25
1
D (m)
280
260
240
D_T Raw
S (ppt)
38
36
34
D_T
D_M
D_B
V (cm/s)
150
100
50
0
−50
−100
D_M
D_B
U (cm/s)
50
0
−50
D_M
D_B
T (°C)
30
20
10
0
D_T
D_M
D_B
April
1979
Date/Time

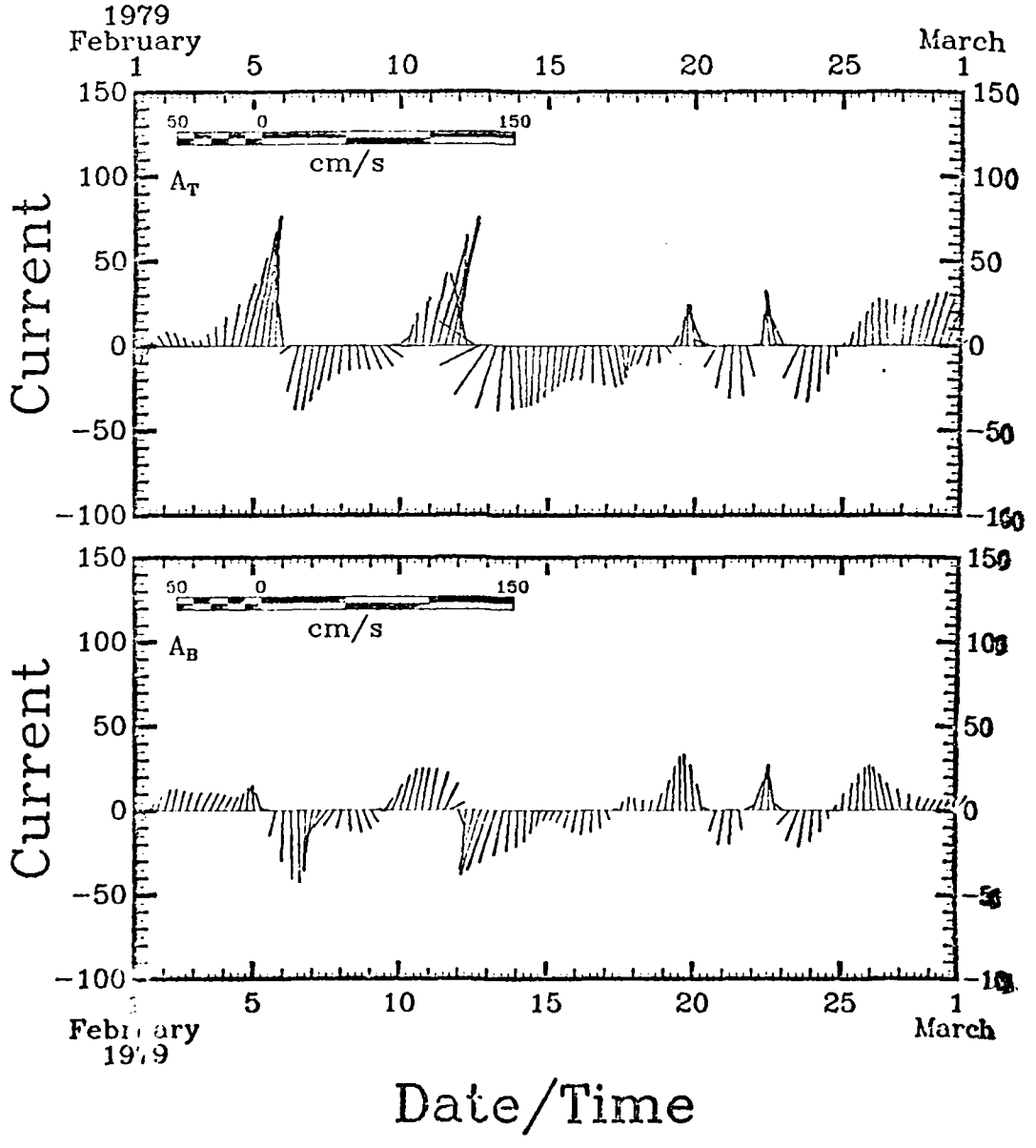

1979
May
June
1
5
10
15
20
25
30
1
D (m)
280
260
240
D_T Raw
S (ppt)
38
36
34
D_T
D_M
D_B
V (cm/s)
150
100
50
0
−50
−100
D_M
U (cm/s)
50
0
−50
D_M
T (°C)
30
20
10
0
D_T
D_M
D_B
May
1979
June
Date/Time

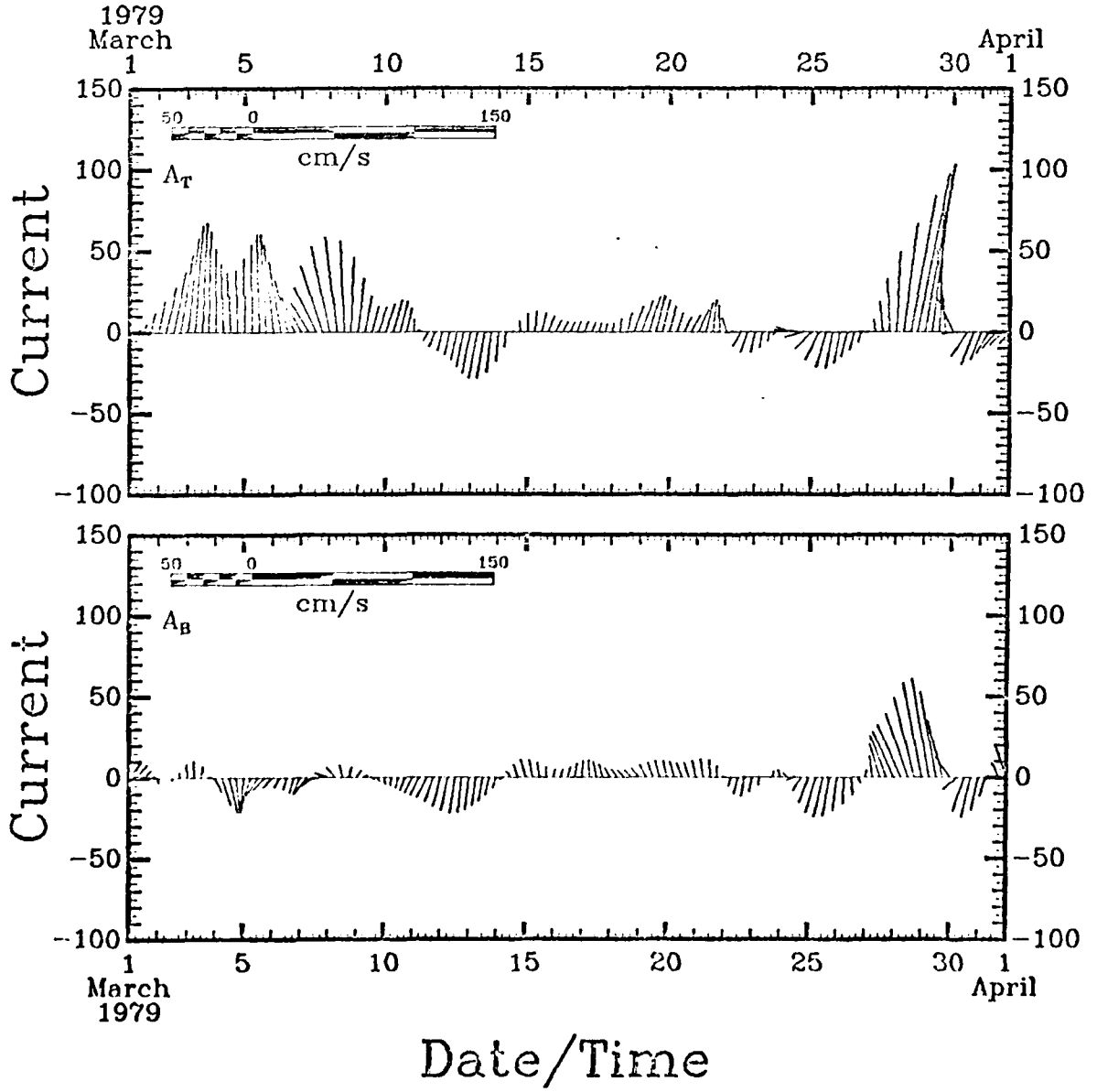
SECTION 6

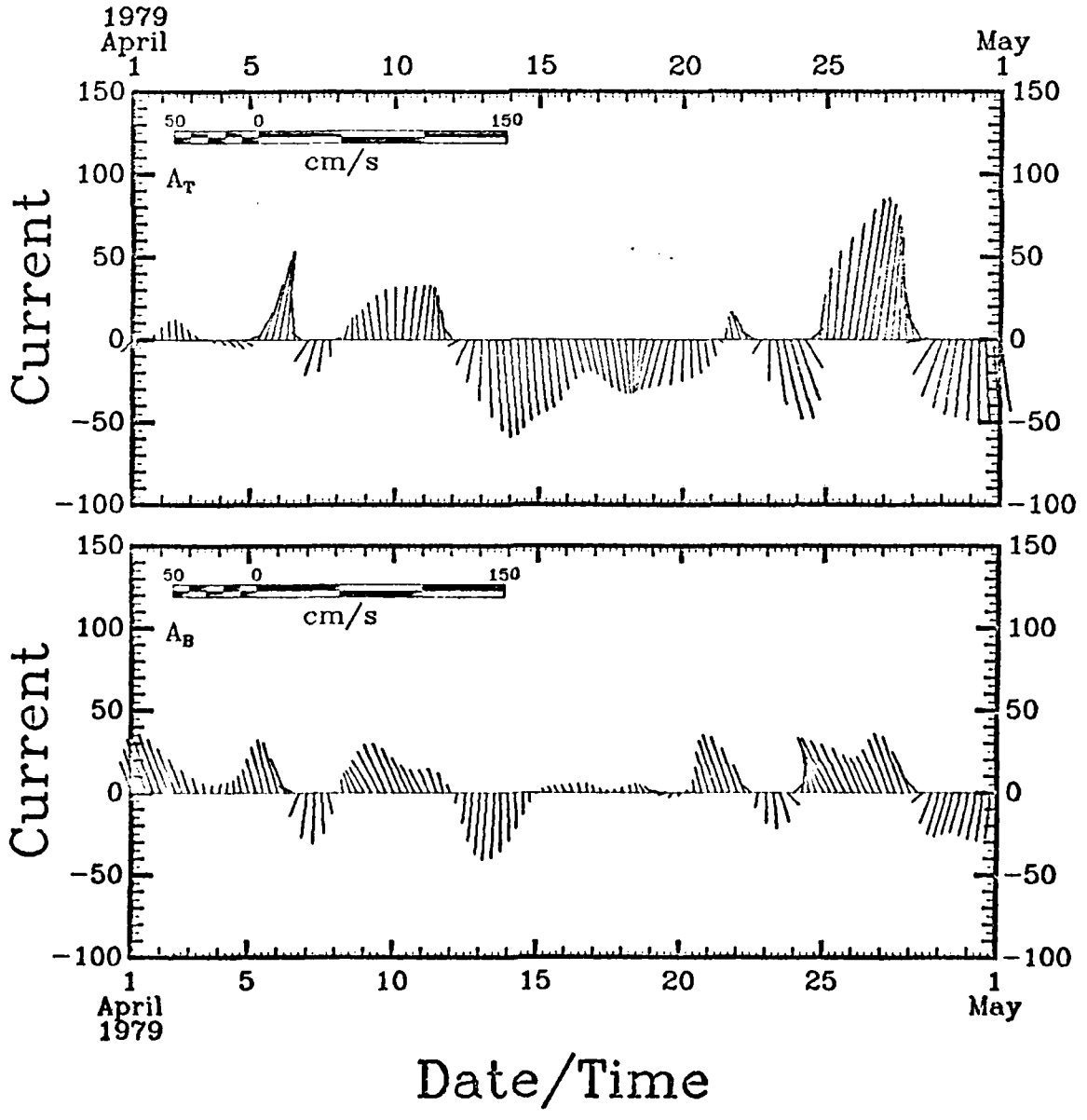
40 HRLP Current Vector "Stick" Plots for Each Mooring

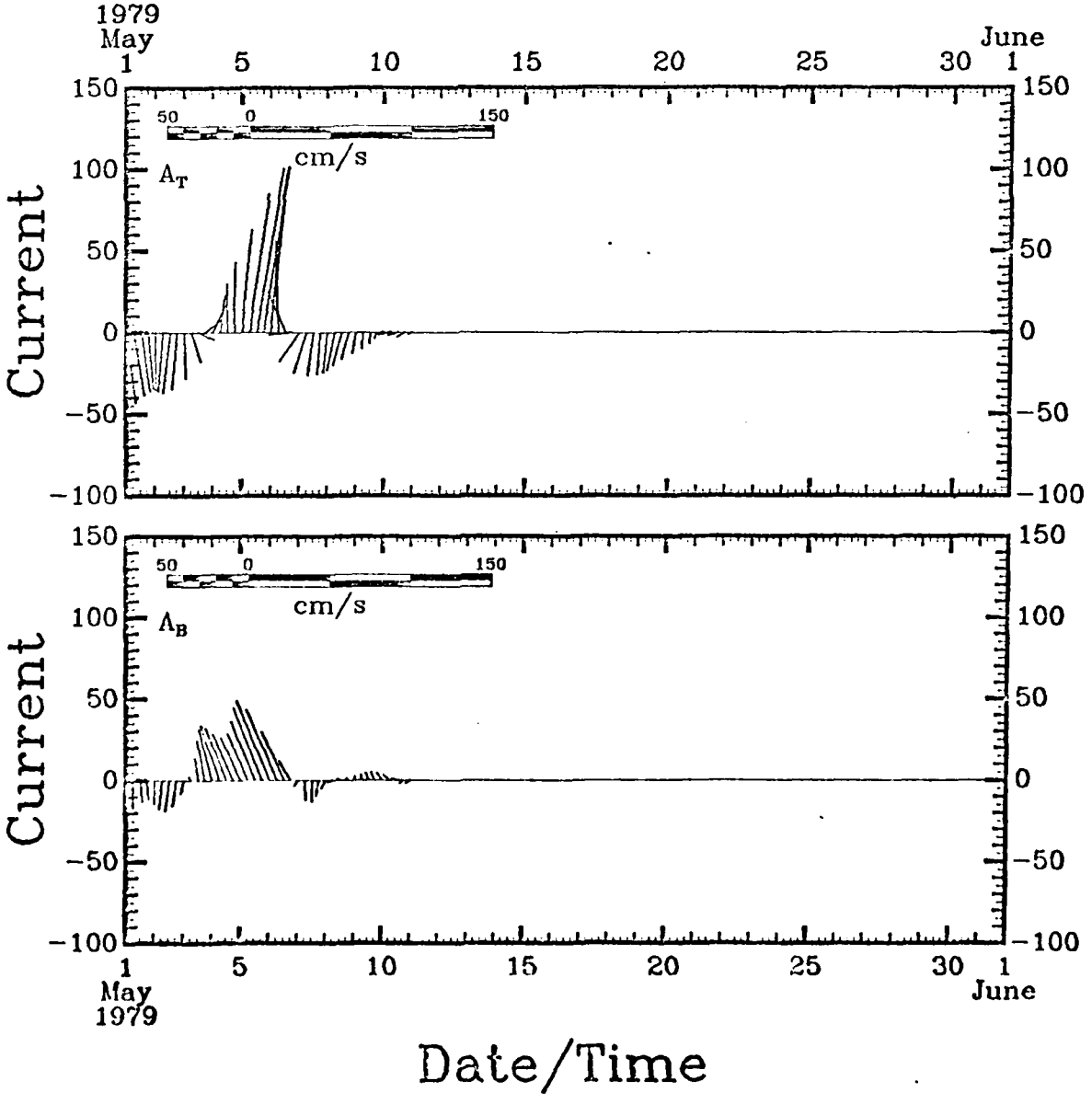
Figures 44 through 47 show the 40 HRLP current vectors in "stick" format by month for each mooring. Vectors pointing toward the top of the page correspond to flow in the downstream (34°T) direction. Common scaling is used in this section.

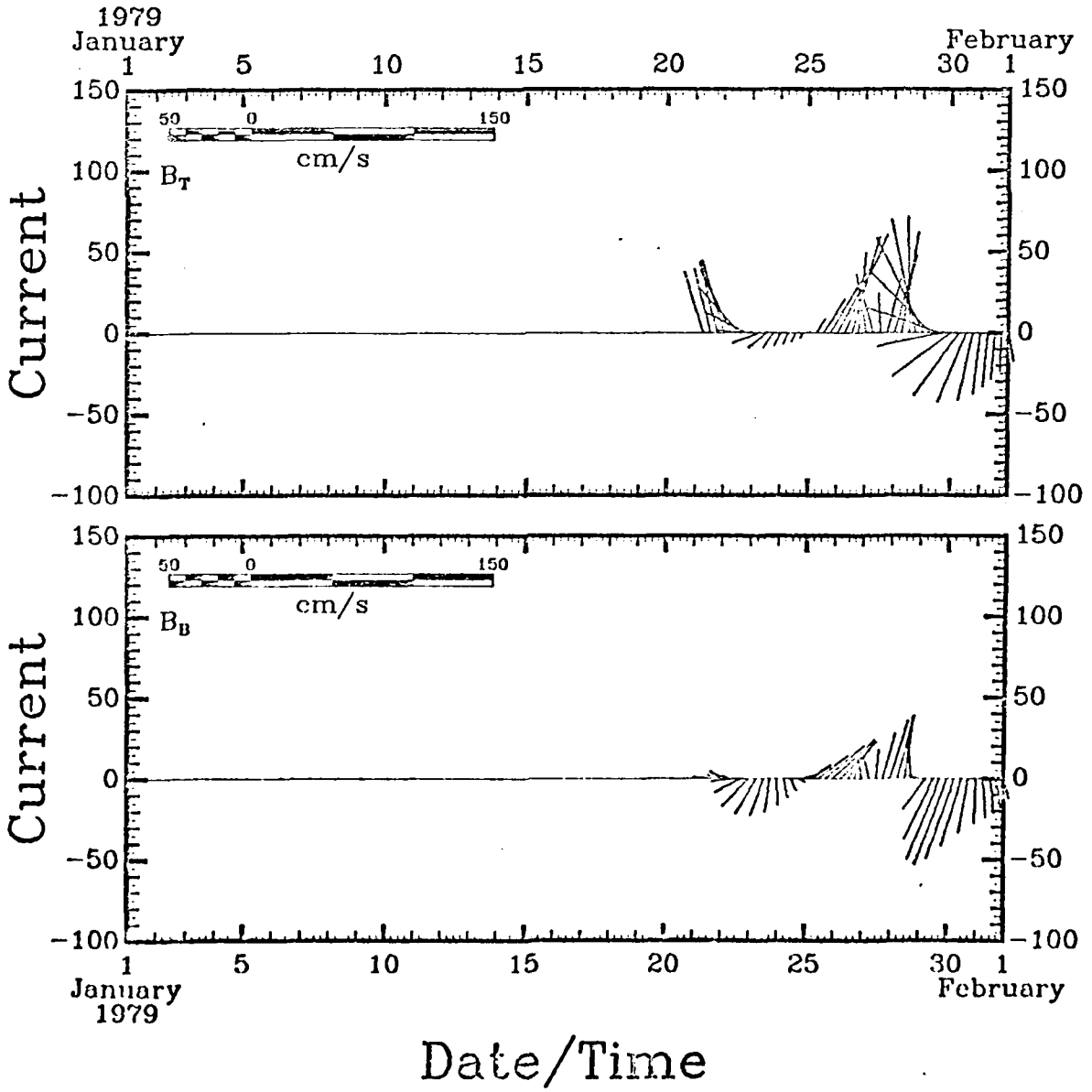

1979
January
February
1
5
10
15
20
25
30
1
150
100
50
0
−50
−100
50
0
150
cm/s
A_T
A_B
Current
Current
January
1979
February
Date/Time

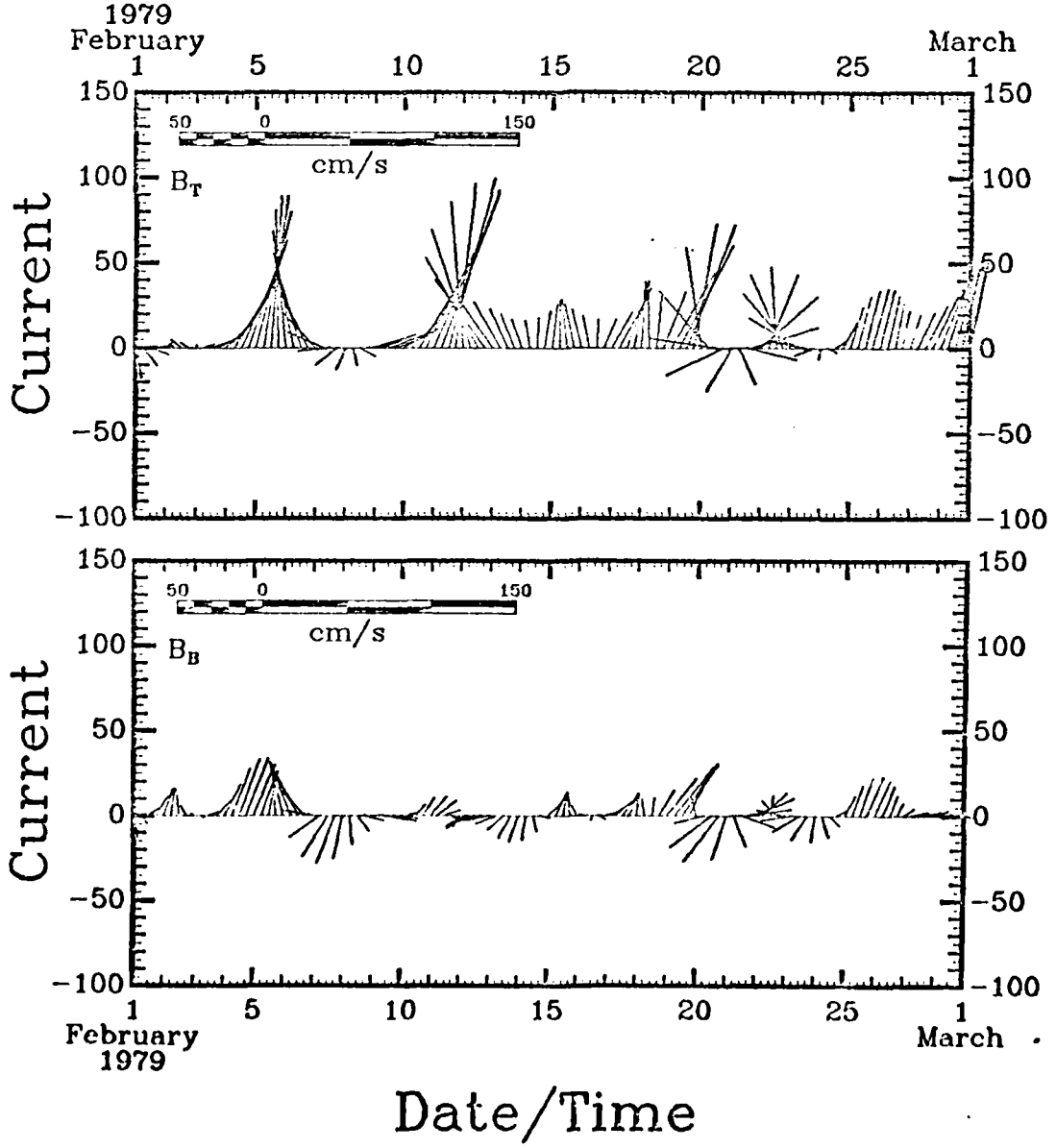

1979
February
March
1
5
10
15
20
25
1
150
100
50
0
−50
−100
50
0
150
cm/s
A_T
A_B
Current
Current
February
1979
March
Date/Time

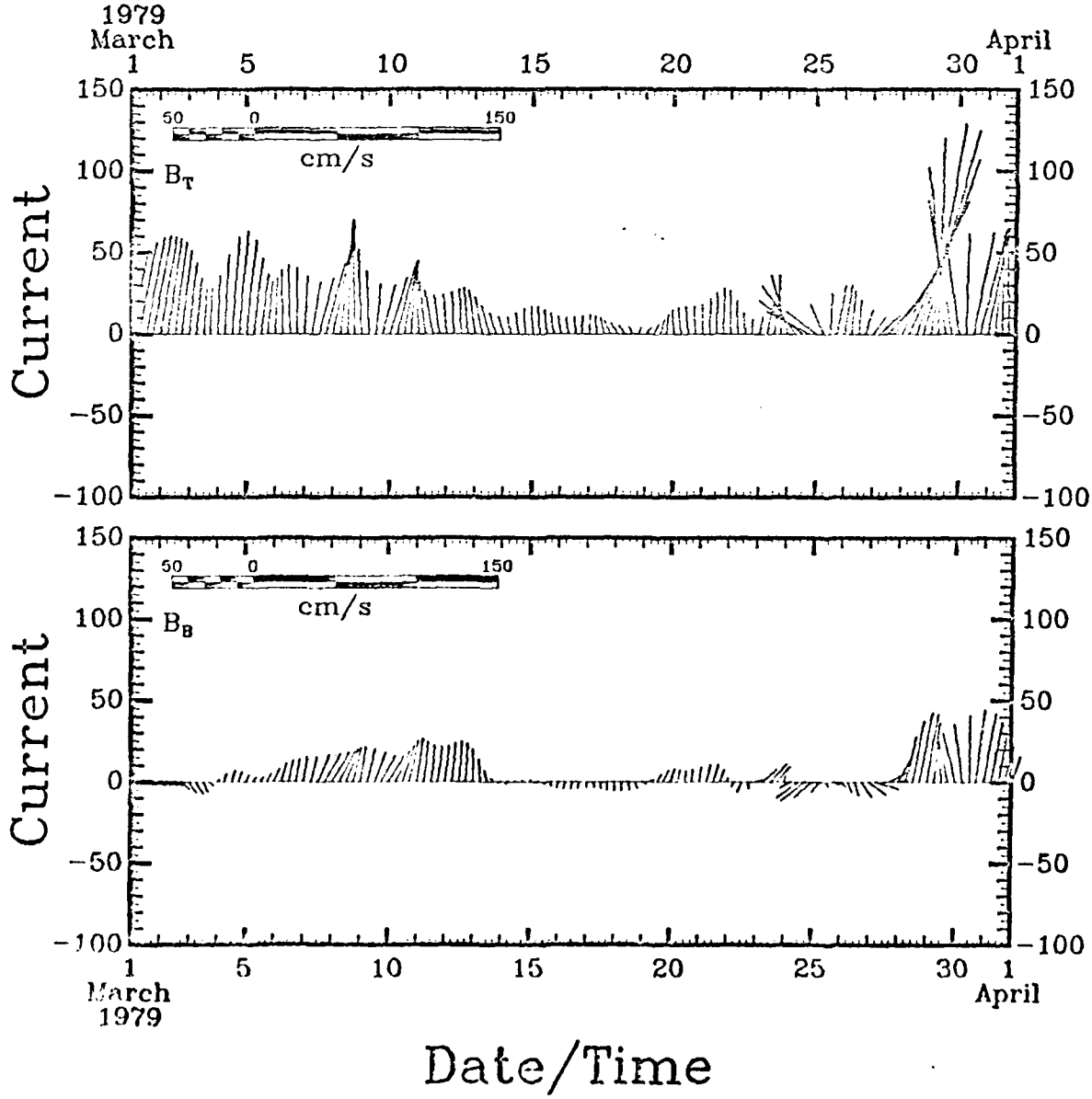

1979
March
1
5
10
15
20
25
30
April
1
150
100
50
0
−50
−100
Current
50
0
150
cm/s
A_T
A_B
Date/Time

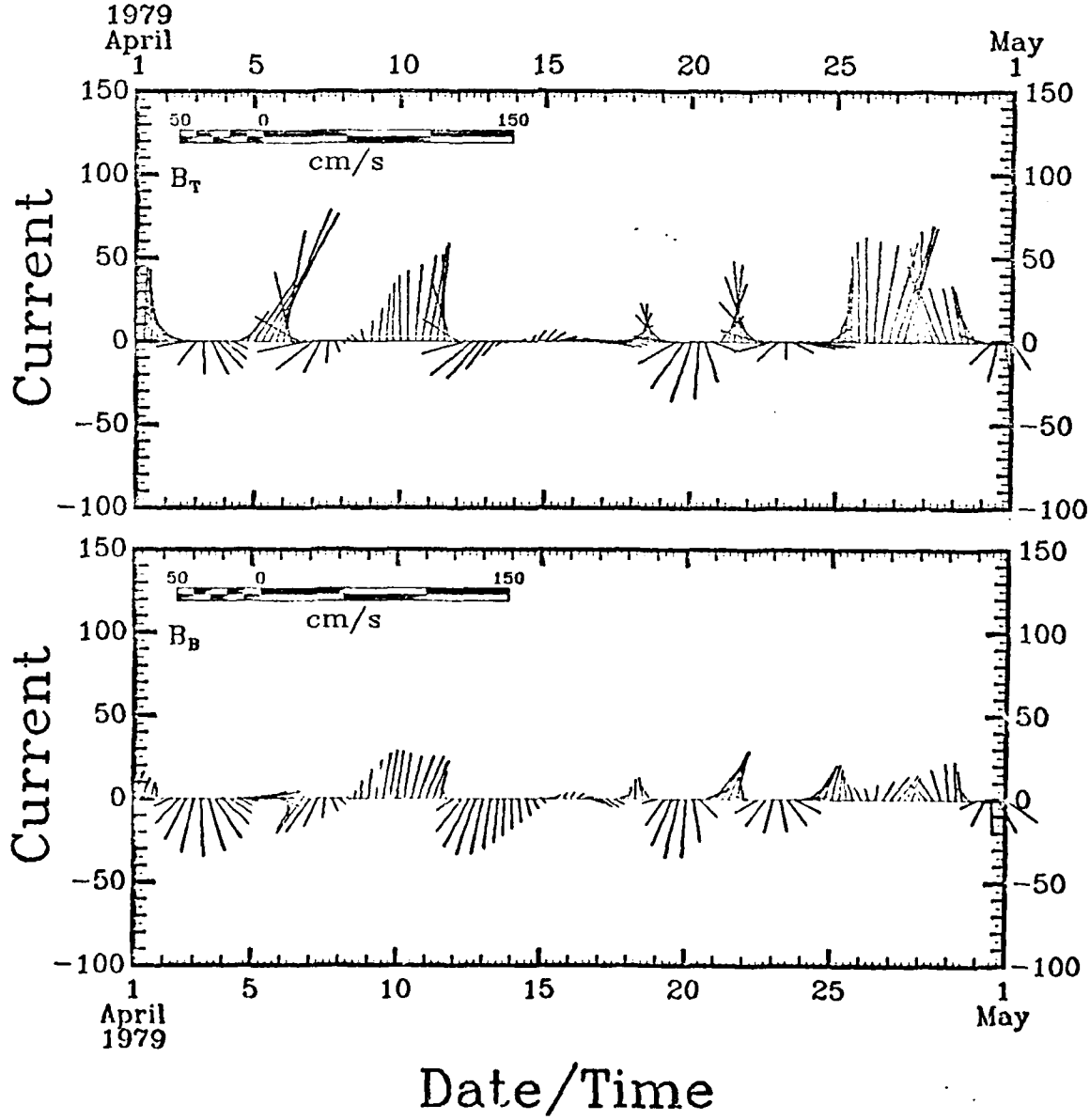

1979
April
1
5
10
15
20
25
May
1
150
100
50
0
−50
−100
50
0
150
cm/s
A_T
Current
A_B
Current
April
1979
May
Date/Time

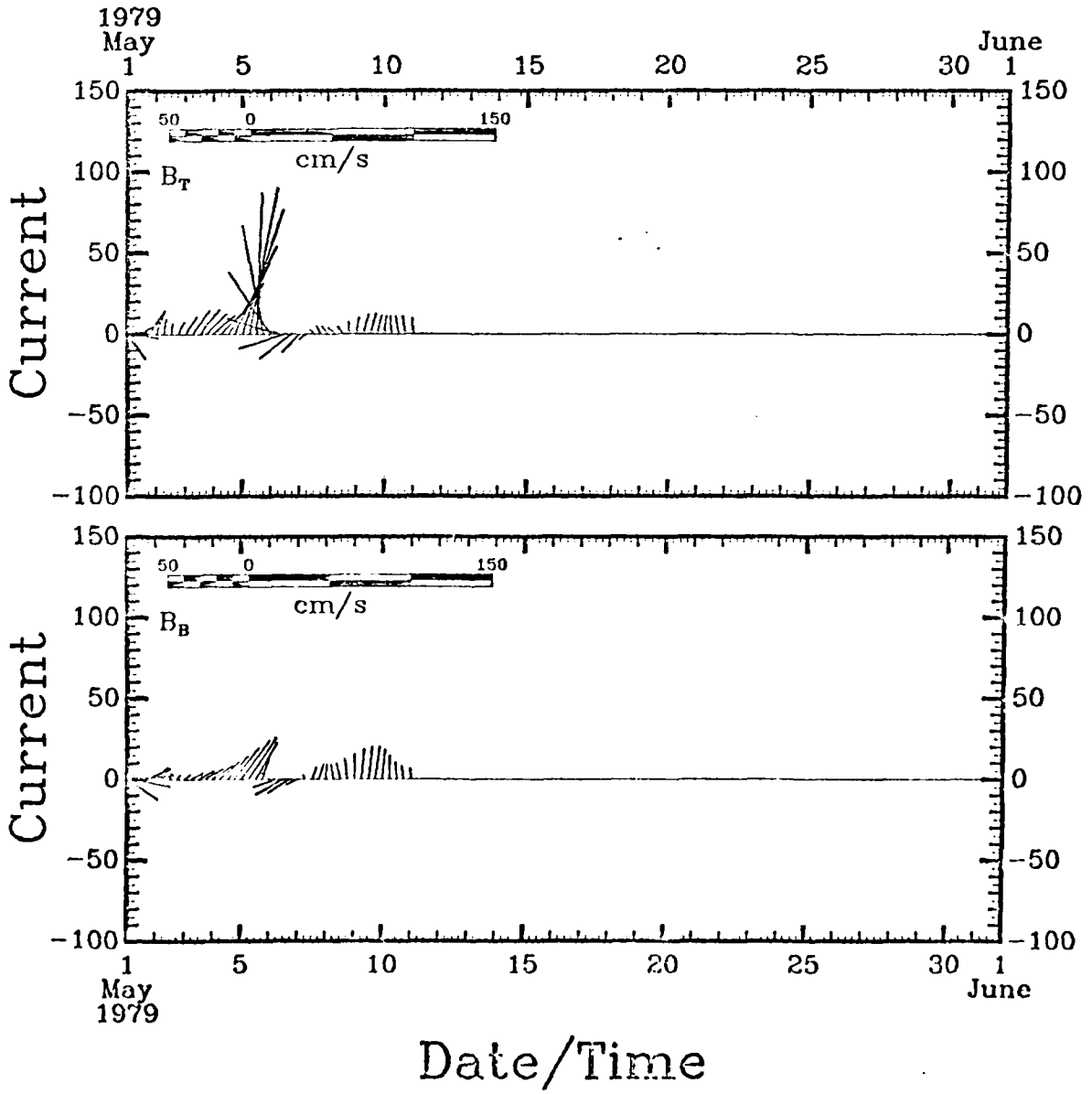

1979
May
June
1
5
10
15
20
25
30
1
150
100
50
0
−50
−100
50
0
150
cm/s
A_T
A_B
Current
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
150
100
50
0
−50
−100
50 0 150
cm/s
B_T
B_B
Current
Current
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

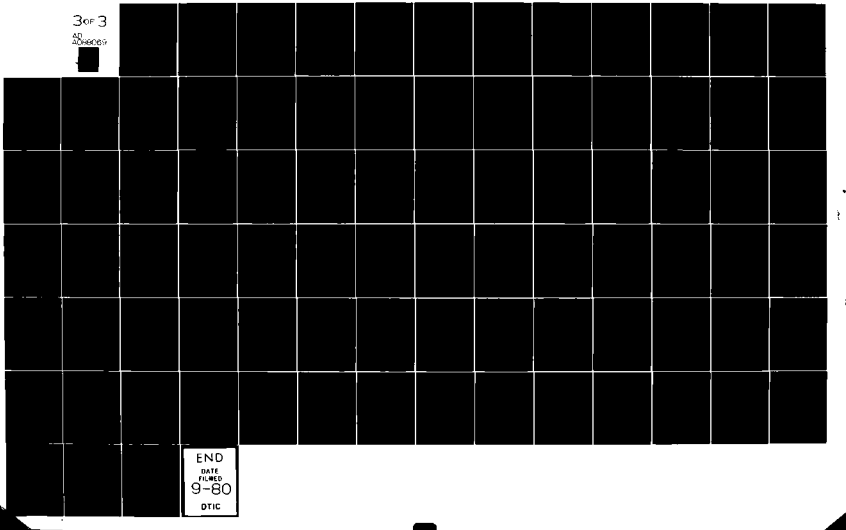

1979
February
March
1
5
10
15
20
25
1
150
100
50
0
−50
−100
50
0
150
cm/s
B_T
B_B
Current
Current
1
February
1979
1
March
Date/Time

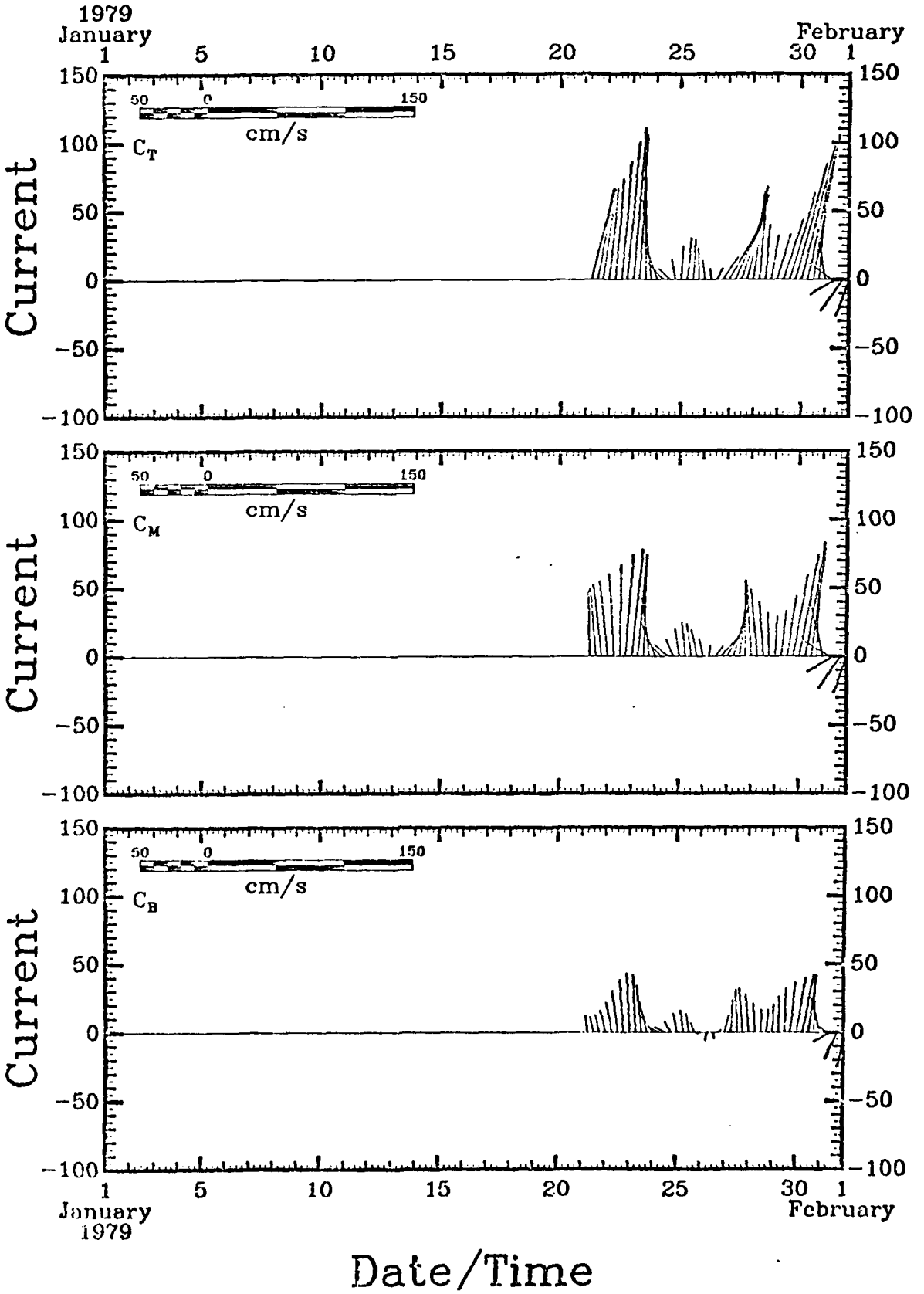

1979
March
April
1
5
10
15
20
25
30
1
150
100
50
0
−50
−100
50
0
150
cm/s
B_T
B_B
Current
Current
March
1979
April
Date/Time

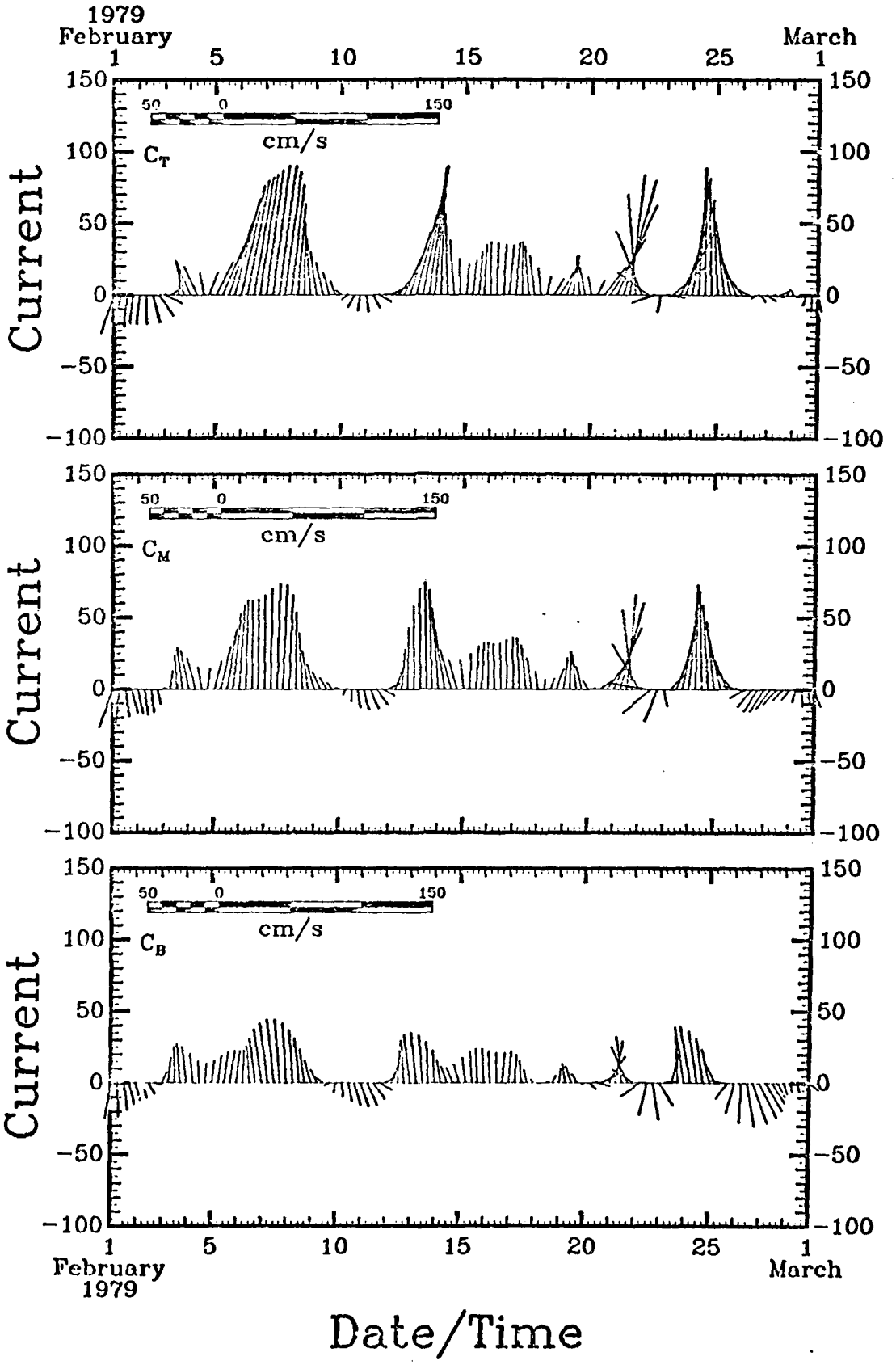

1979
April
May
1
5
10
15
20
25
150
100
50
0
−50
−100
50
0
150
cm/s
B_T
B_B
Current
Date/Time

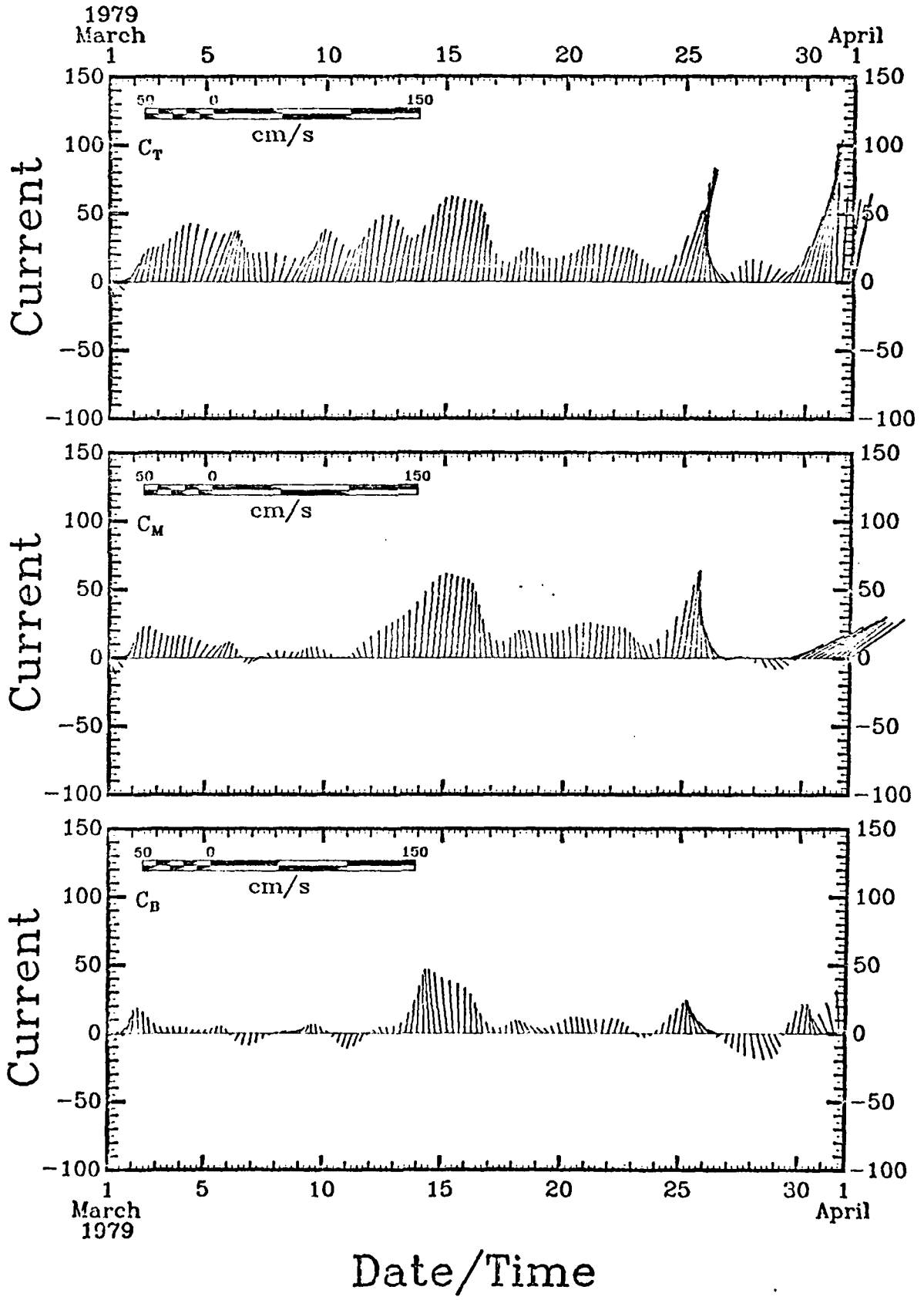

1979
May
1
5
10
15
20
25
30
June
1
150
100
50
0
−50
−100
50
0
150
cm/s
B_T
Current
B_B
Current
Date/Time

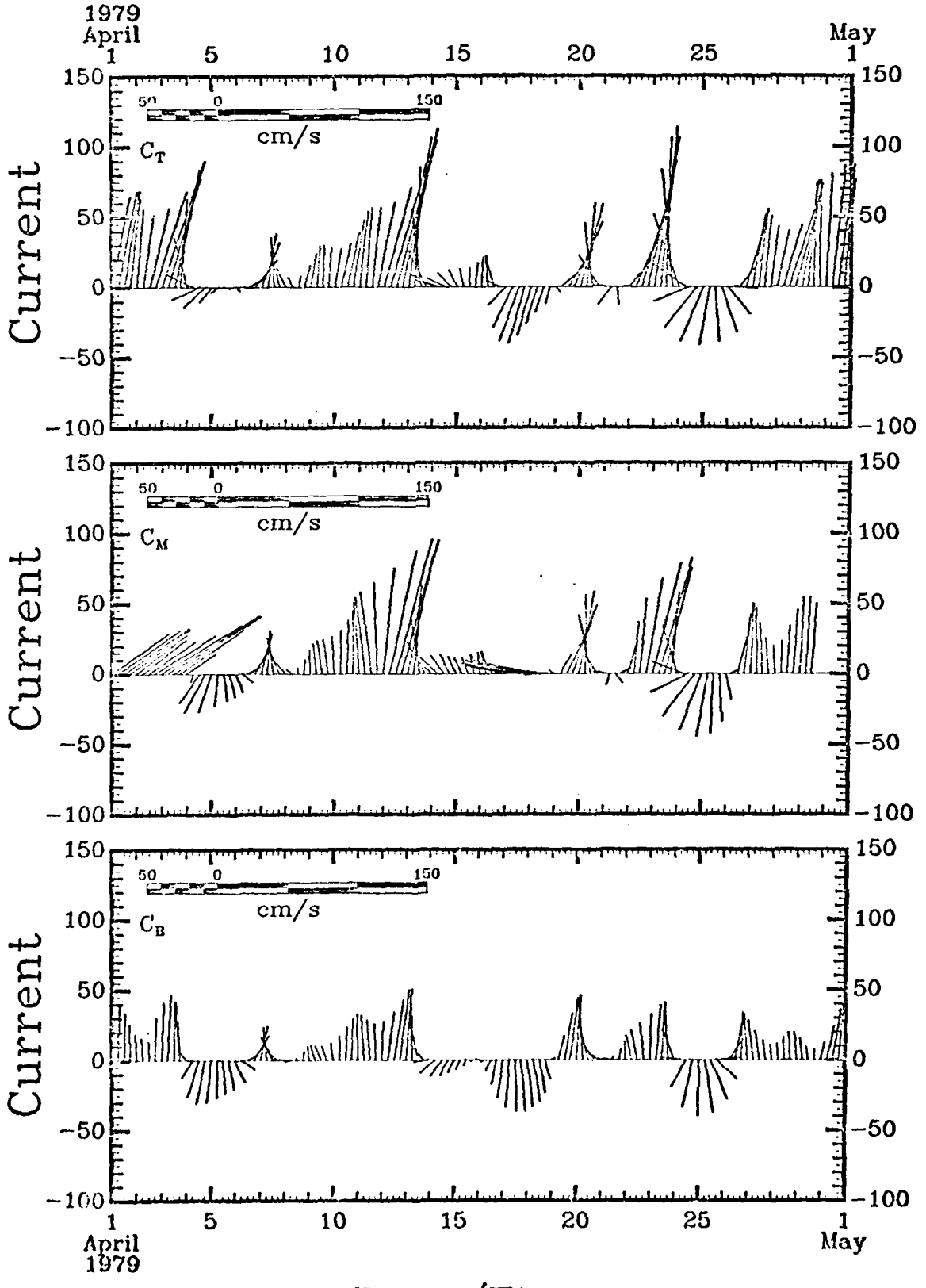
AD-A088 069 TEXAS A AND M UNIV COLLEGE STATION DEPT OF OCEANOGRAPHY F/G 8/3
THE GULF STREAM MEANDERS EXPERIMENT, CURRENT METER, ATMOSPHERIC--ETC(U)
JUL 80 D A BROOKS, J M BANE, R L COHEN N00014-77-C-0354
UNCLASSIFIED TAMU-REF-80-7-T NL

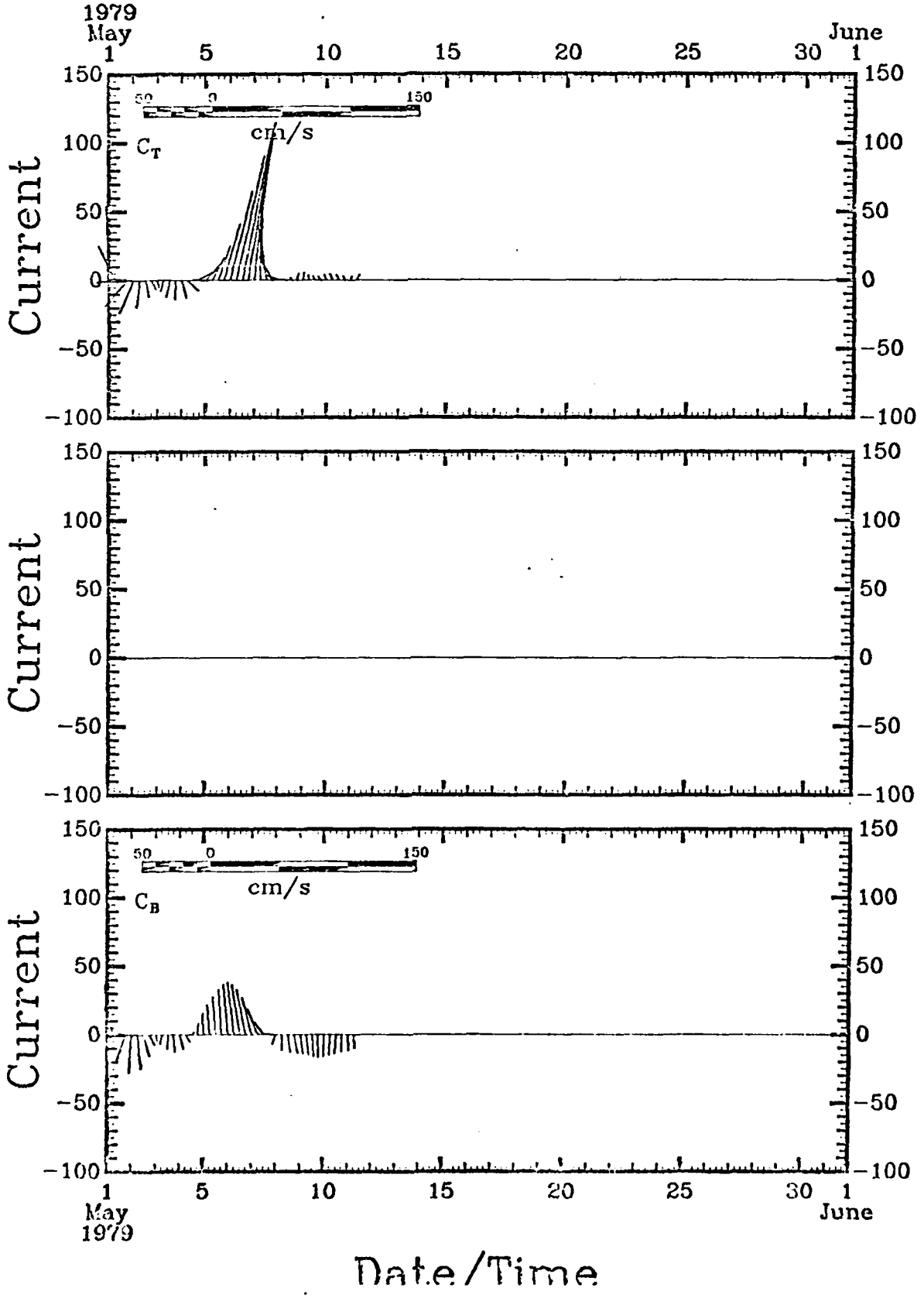


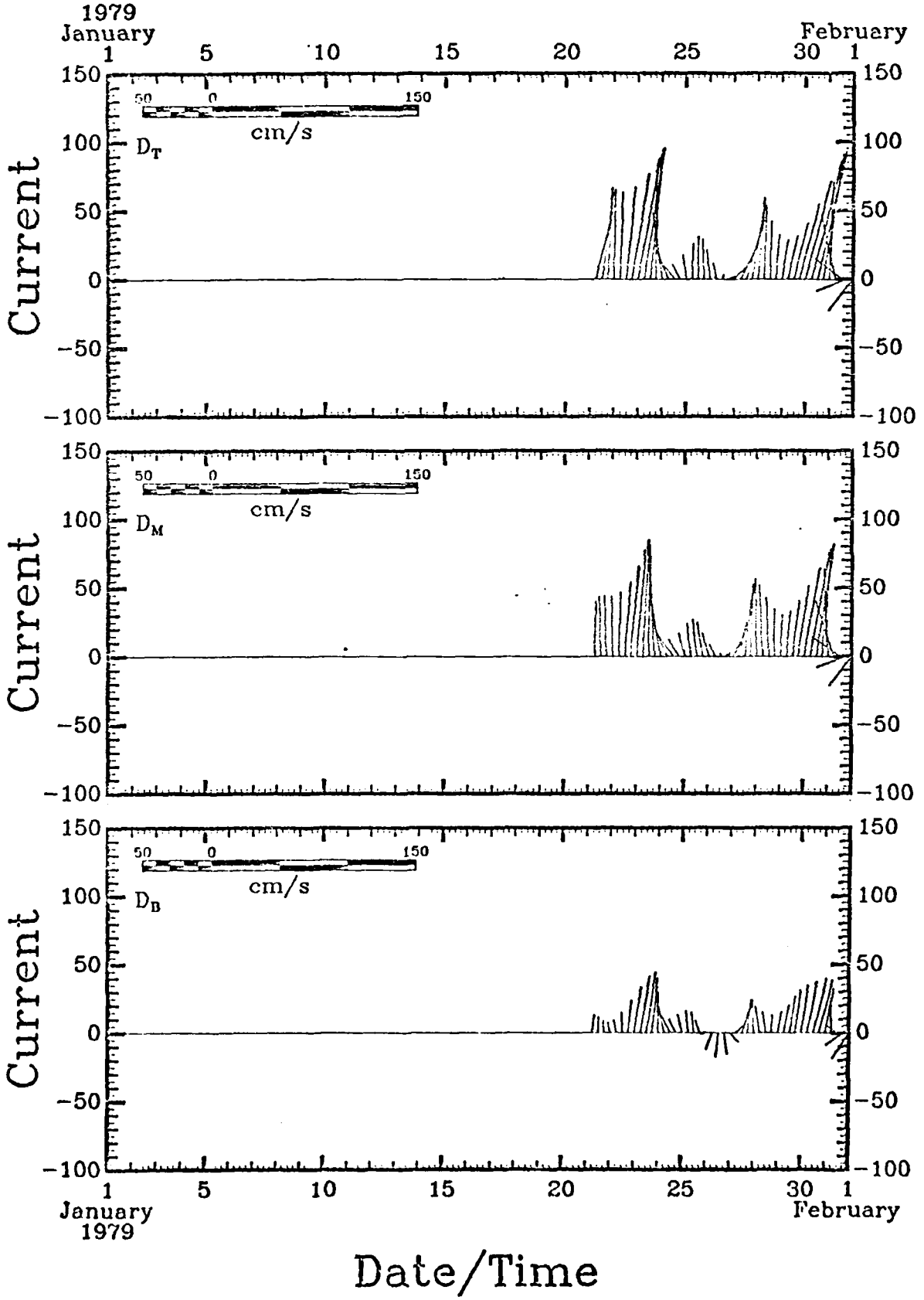

1979
January
February
1 5 10 15 20 25 30 1
150
100
50
0
−50
−100
50 0 150
cm/s
C_T
C_M
C_B
Current
1 5 10 15 20 25 30 1
January
1979
February
Date/Time

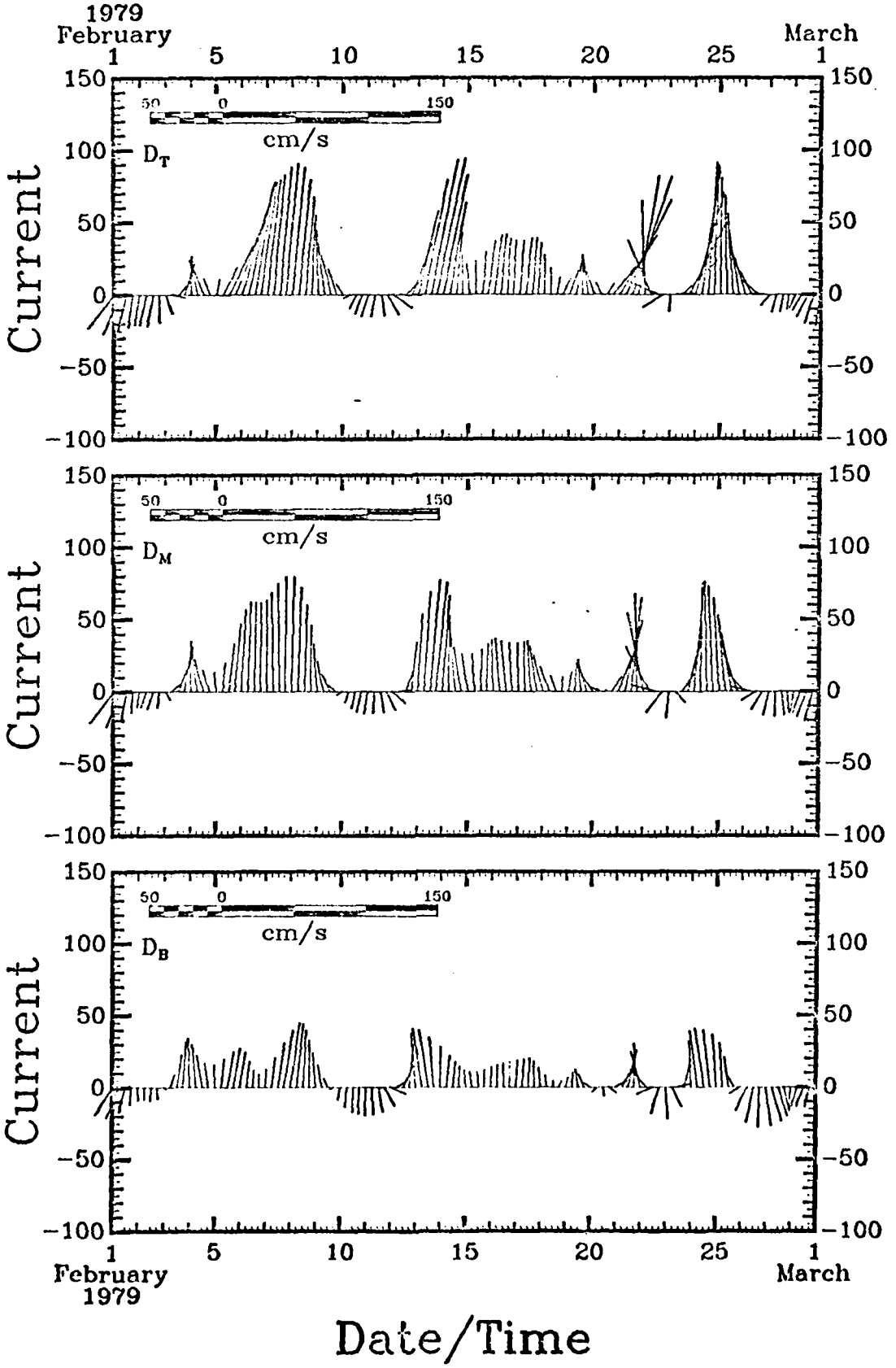

1979
February
March
1
5
10
15
20
25
1
150
100
50
0
−50
−100
50
0
150
cm/s
C_T
C_M
C_B
Current
Current
Current
1
February
1979
1
March
Date/Time

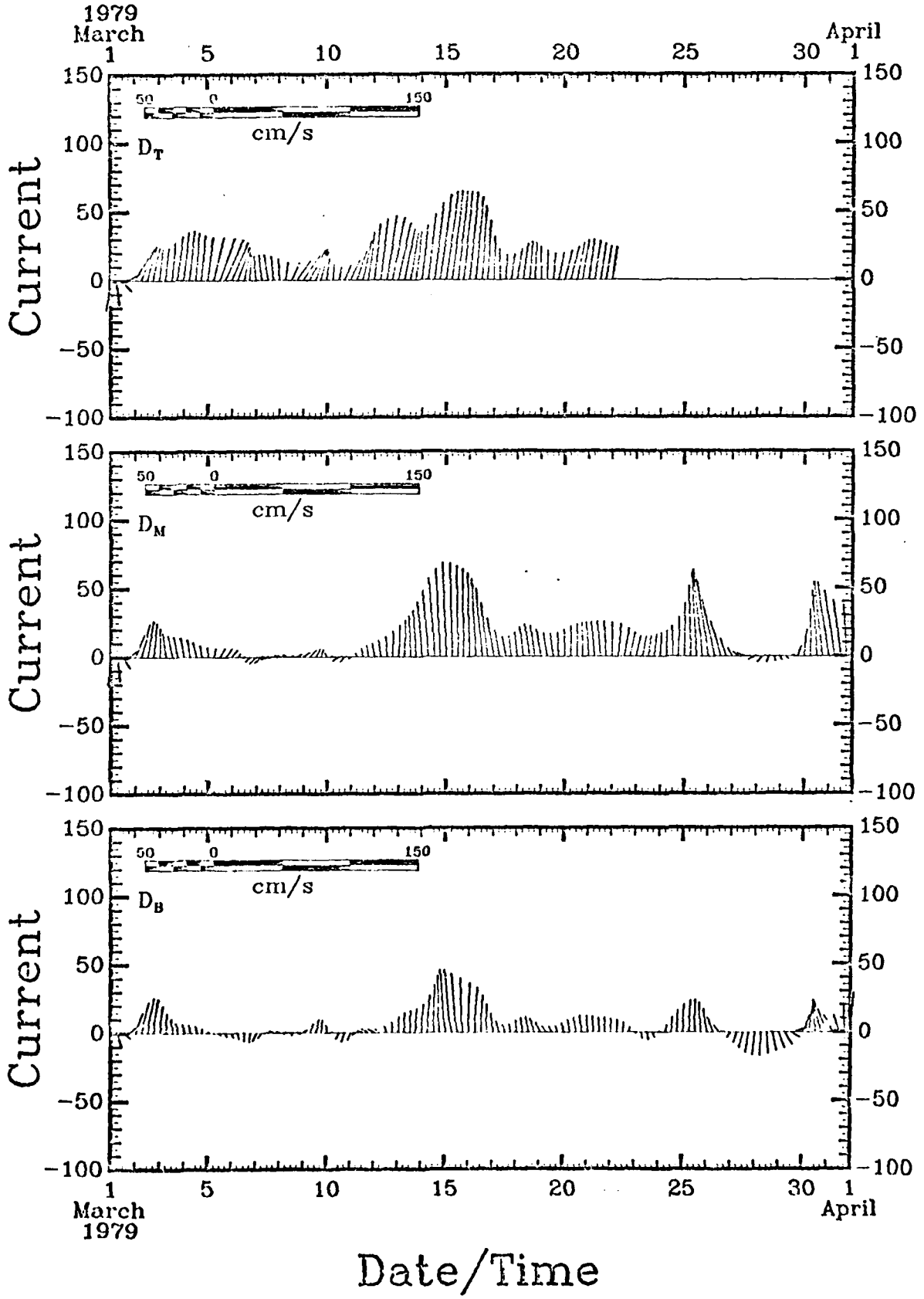

1979
March
April
1
5
10
15
20
25
30
1
150
100
50
0
−50
−100
50
0
150
cm/s
C_T
C_M
C_B
Current
Current
Current
1
March
1979
Date/Time

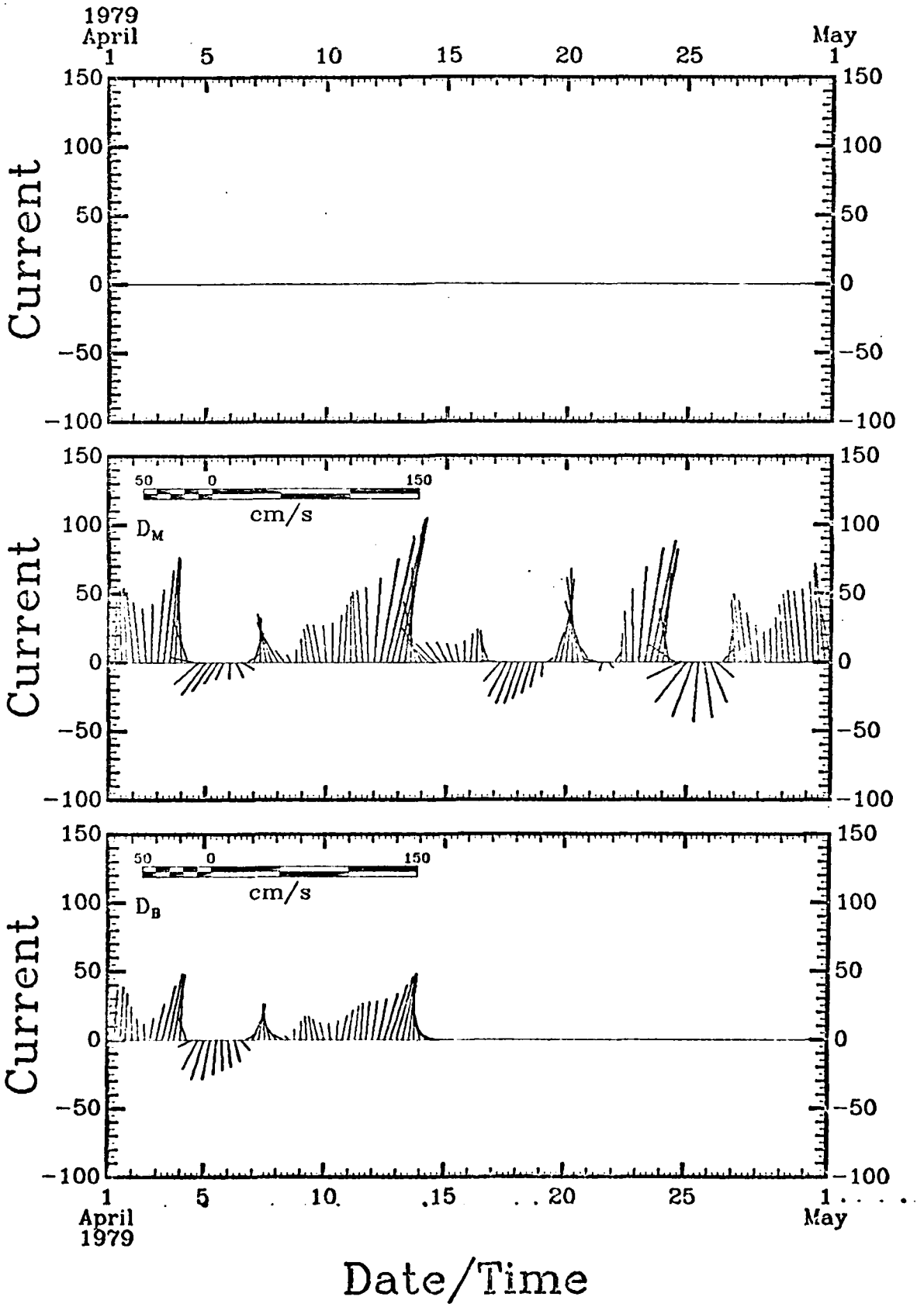

1979
April
May
1
5
10
15
20
25
150
100
50
0
−50
−100
50
0
150
cm/s
C_T
C_M
C_B
Current
Date/Time

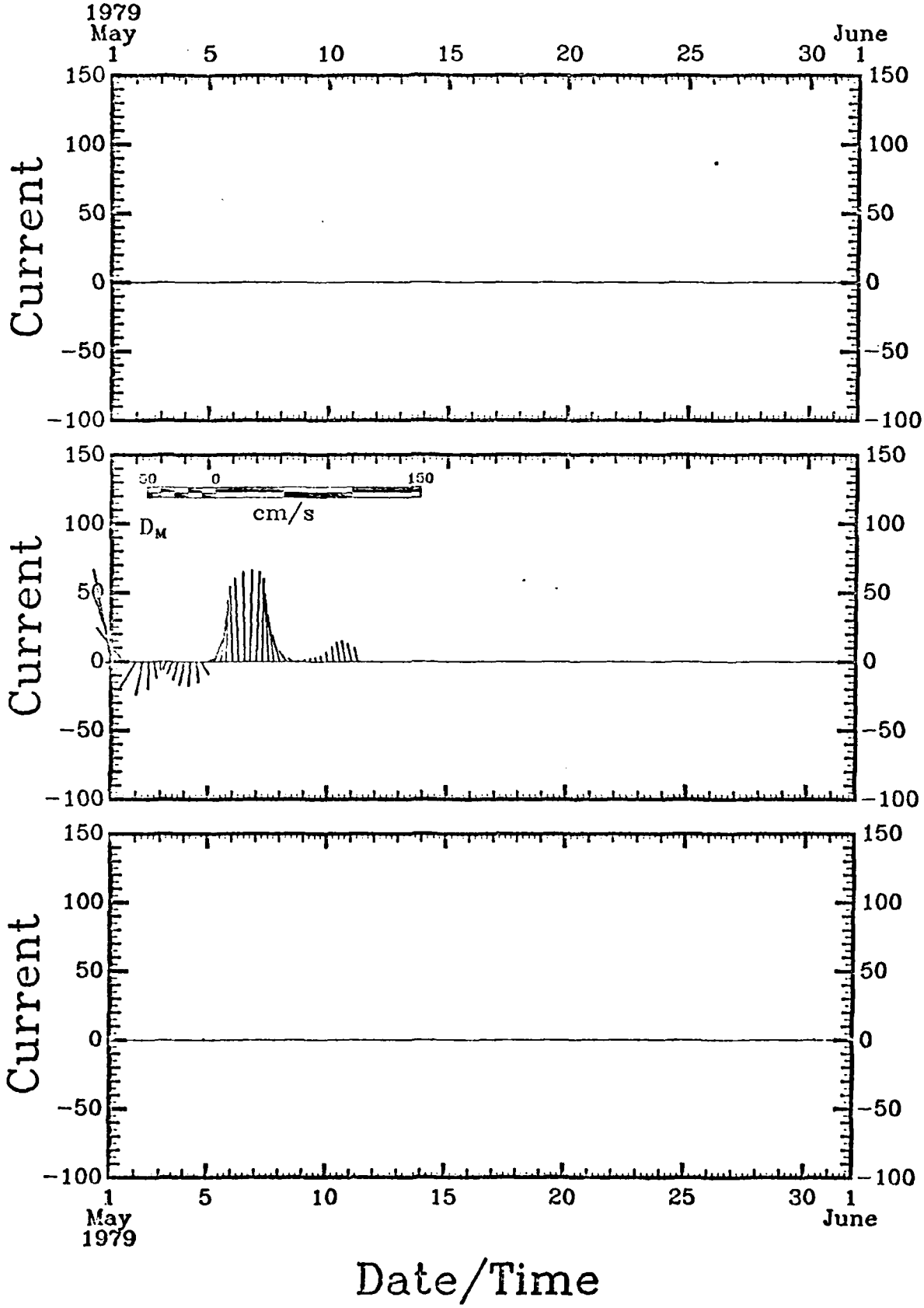

1979
May
June
1
5
10
15
20
25
30
1
150
100
50
0
−50
−100
Current
C_T
C_B
50
0
150
cm/s
Date/Time


1979
January
February
1 5 10 15 20 25 30 1
150
100
50
0
−50
−100
50 0 150
cm/s
D_T
D_M
D_B
Current
1 5 10 15 20 25 30 1
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
150
100
50
0
−50
−100
50
0
150
cm/s
D_T
D_M
D_B
Current
1
February
1979
March
Date/Time


1979
March
1
5
10
15
20
25
30
April
1
150
100
50
0
−50
−100
50
0
150
cm/s
D_T
D_M
D_B
Current
Date/Time

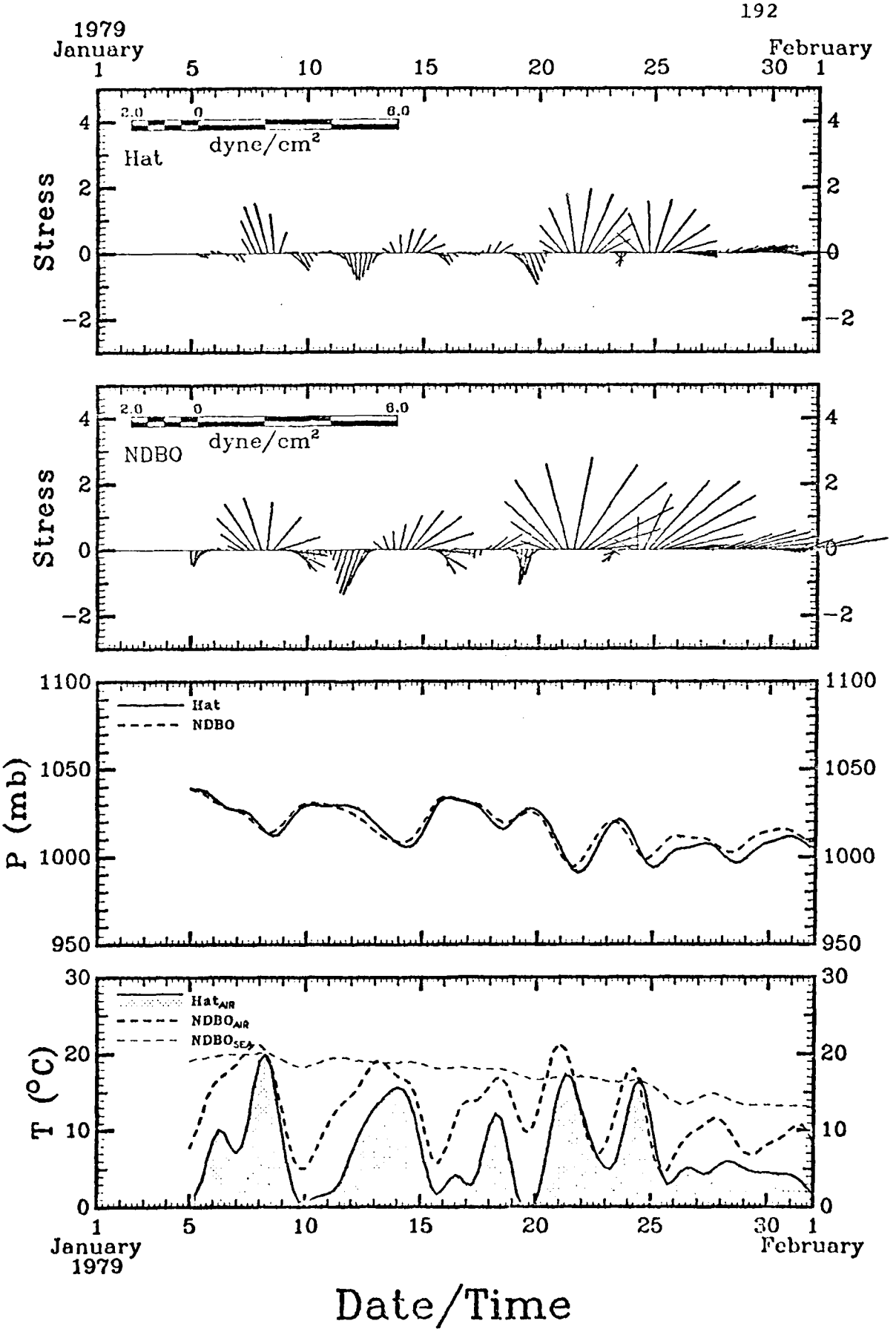

1979
April
1
5
10
15
20
25
May
1
150
100
50
0
−50
−100
Current
50
0
150
cm/s
D_M
D_B
1
April
1979
May
Date/Time

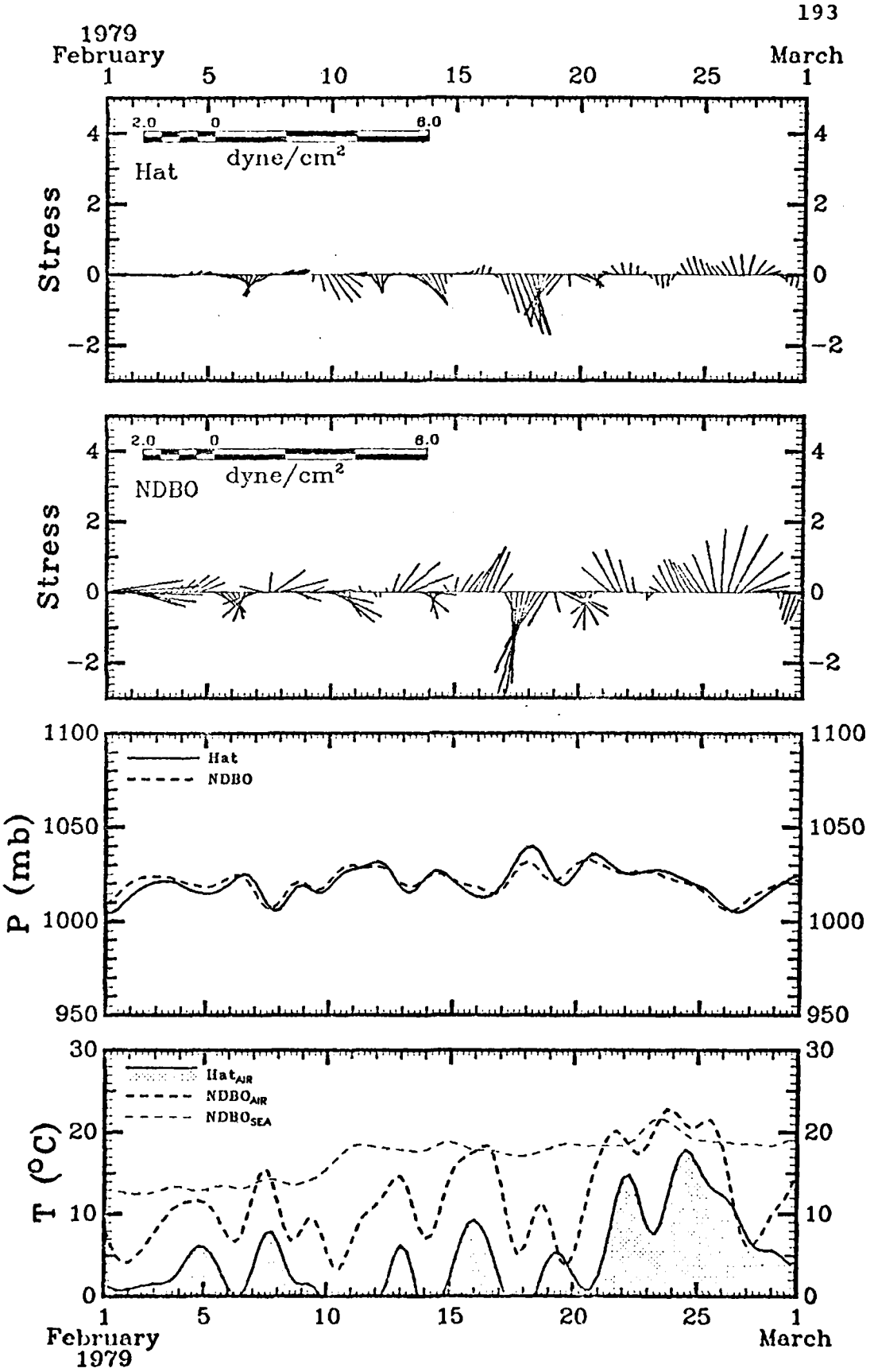

1979
May
1
5
10
15
20
25
30
June
1
Current
150
100
50
0
−50
−100
50
0
150
cm/s
D_M
Date/Time

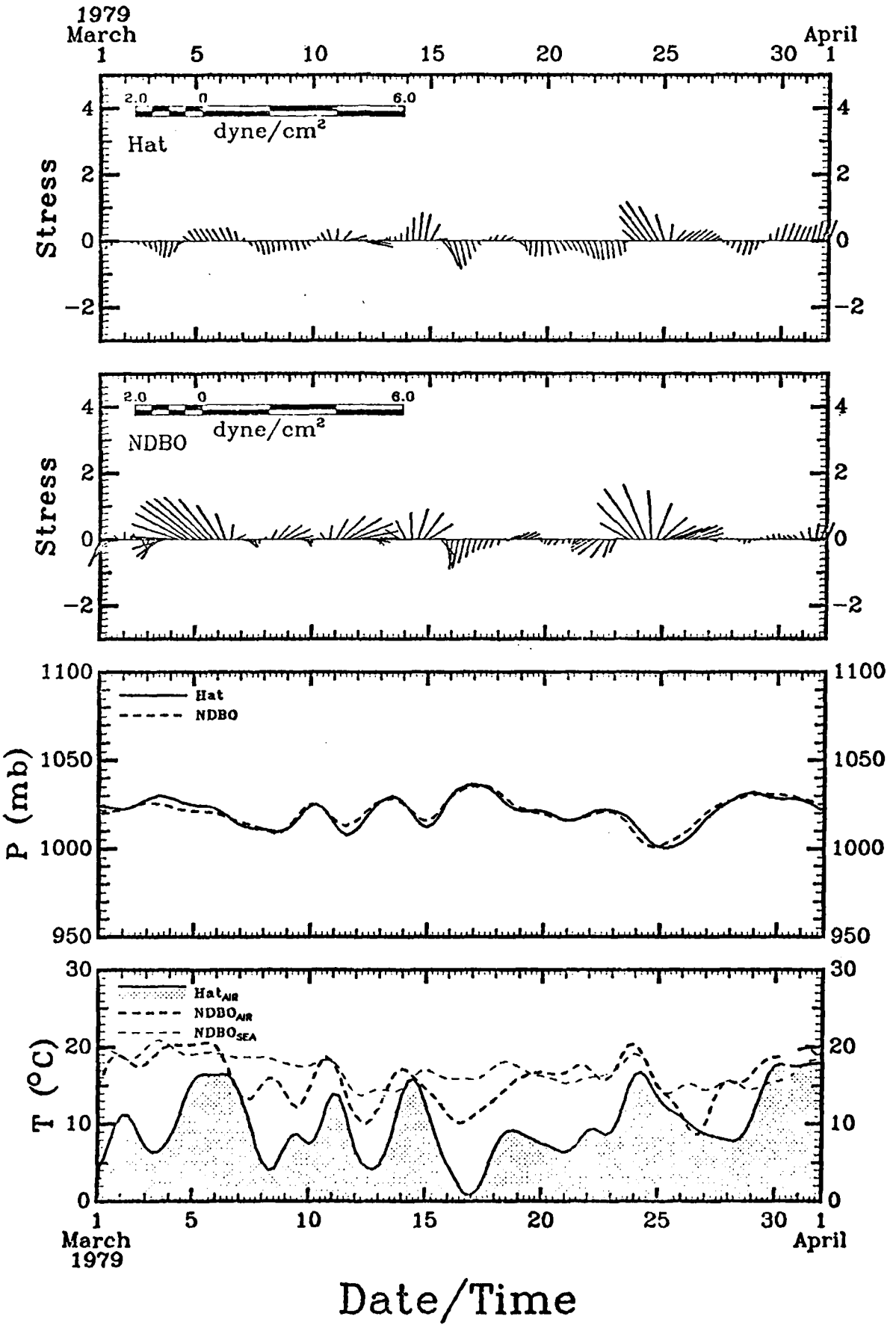
SECTION 7

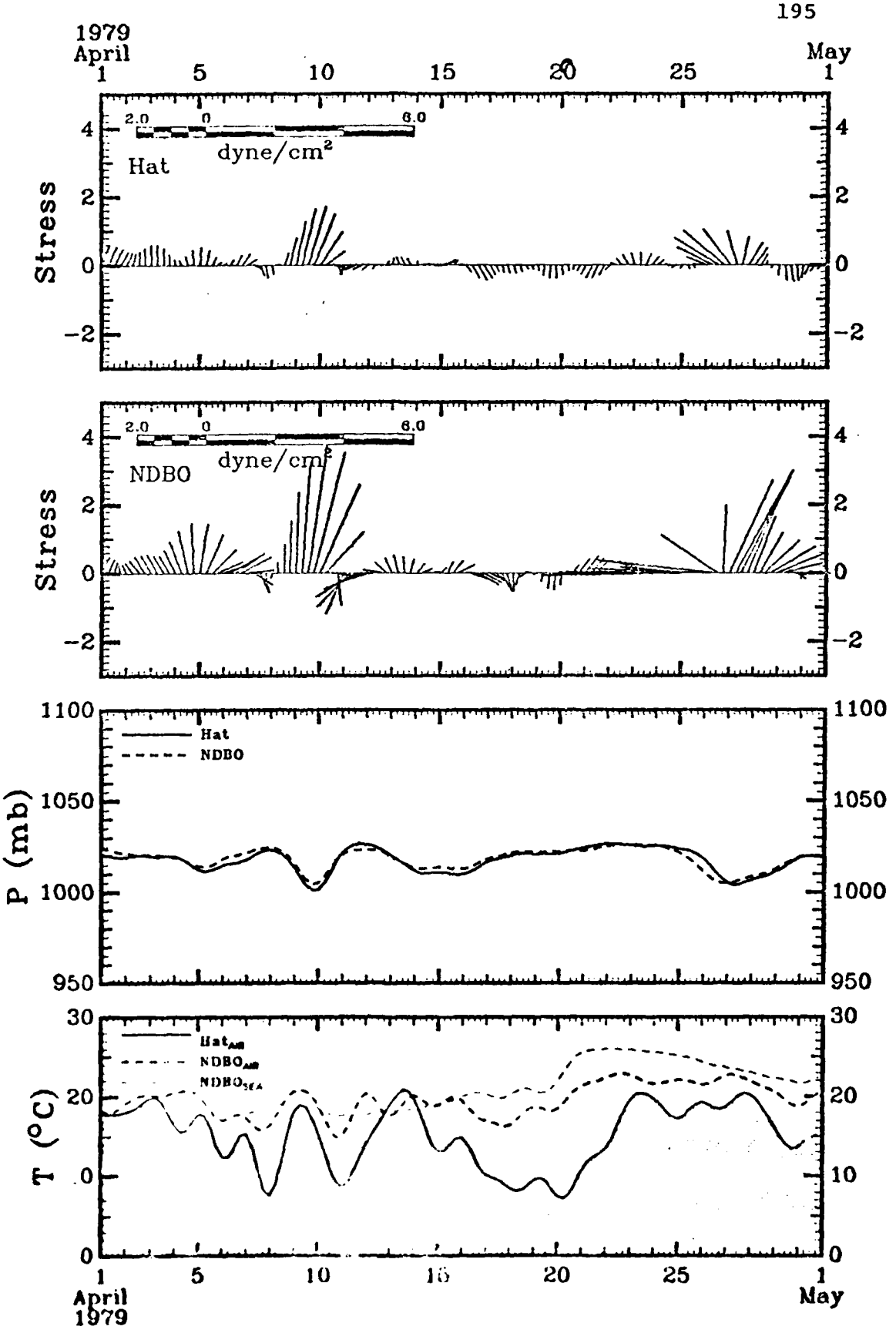
40 HRLP Atmospheric Data from Cape Hatteras and NDBO Buoy 41004

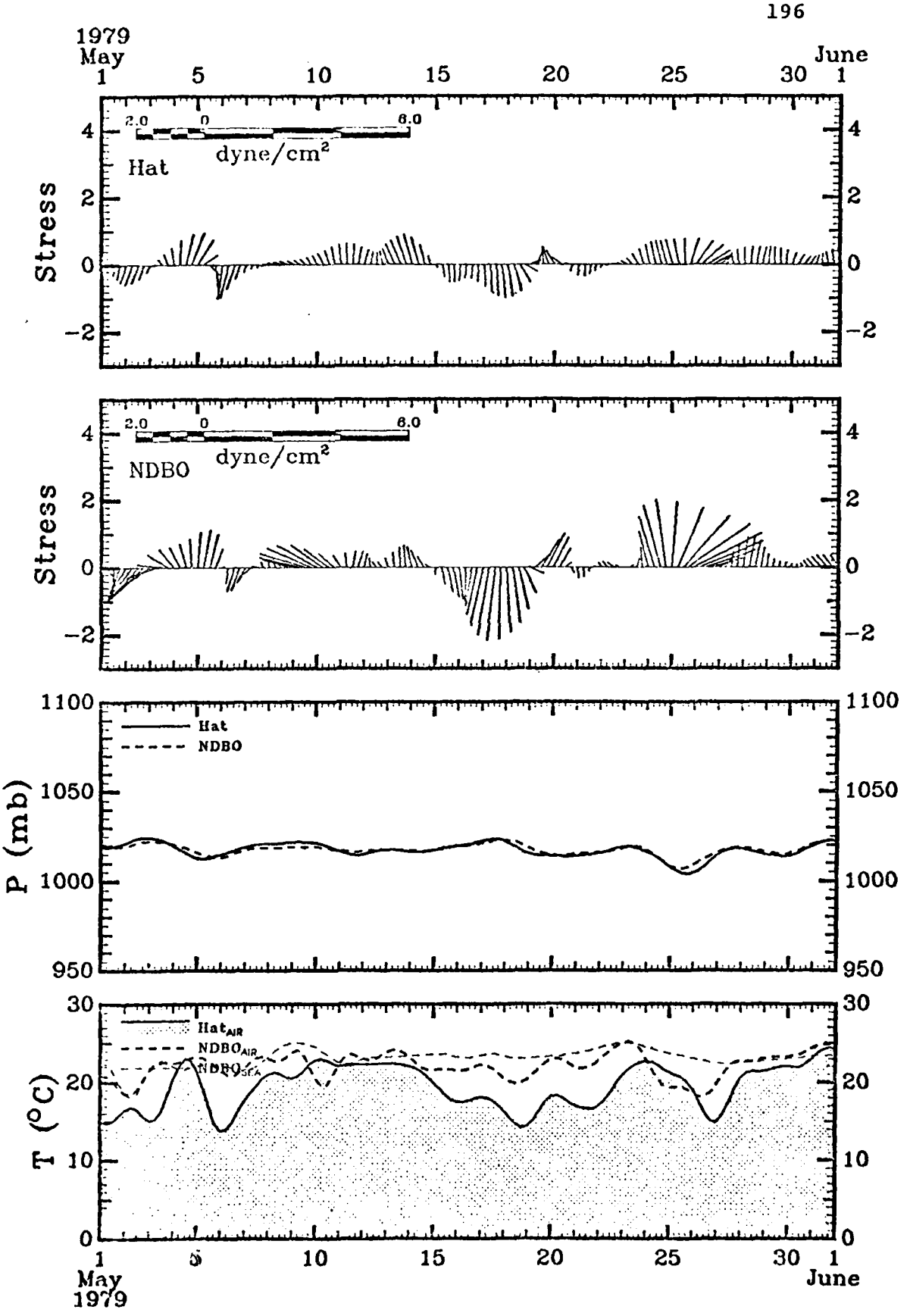
Figure 48 shows by month the 40 HRLP wind stress vector "sticks", the atmospheric pressure, and the air and sea temperatures at Cape Hatteras and the NDBO–4 buoy (see Fig. 1). Vectors pointing toward the top of the page correspond to flow in the downstream (34°T) direction. Common scaling is used in this section.

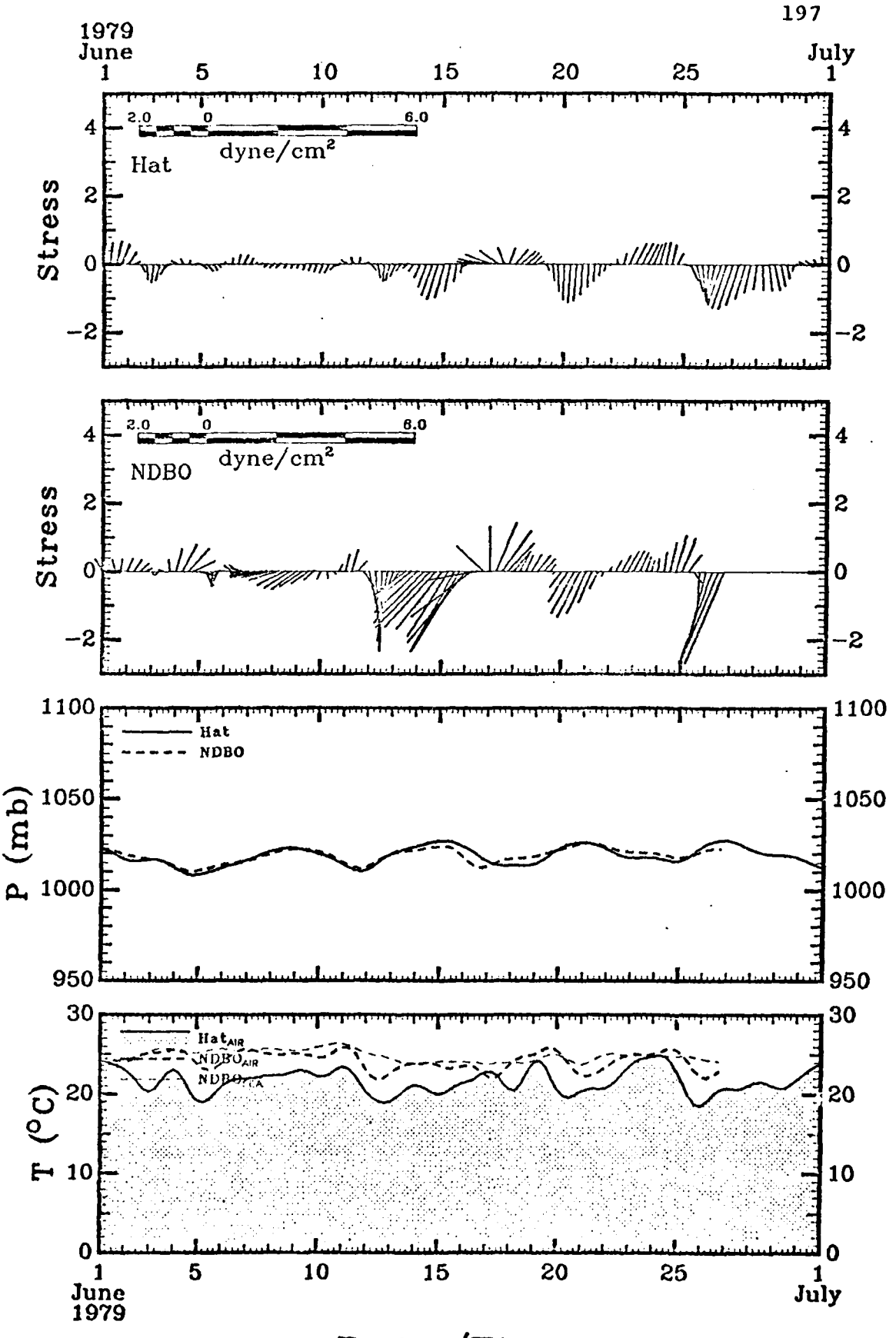

1979
January
February
1 5 10 15 20 25 30 1
2.0 0 6.0
dyne/cm²
Hat
Stress
NDBO
P (mb)
1100
1050
1000
950
Hat
NDBO
T (°C)
Hat$_{AIR}$
NDBO$_{AIR}$
NDBO$_{SEA}$
Date/Time

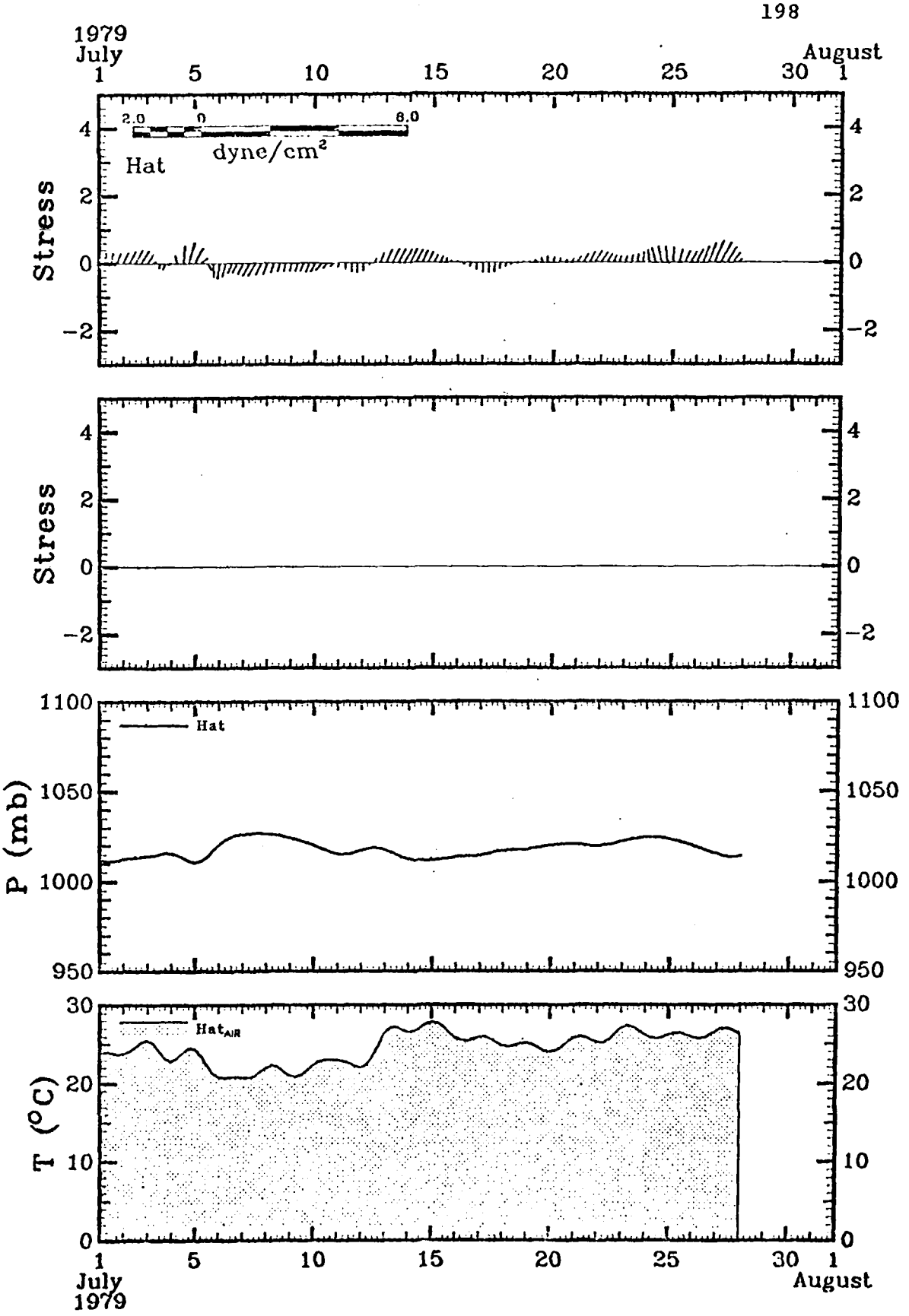

1979
February
March
1
5
10
15
20
25
1
2.0
0
6.0
dyne/cm²
Hat
NDBO
Stress
4
2
0
−2
P (mb)
1100
1050
1000
950
Hat
NDBO
T (°C)
30
20
10
0
Hat_AIR
NDBO_AIR
NDBO_SEA
Date/Time


1979
March
April
1
5
10
15
20
25
30
1
2.0
0
6.0
dyne/cm²
Hat
Stress
NDBO
P (mb)
1100
1050
1000
950
Hat
NDBO
T (°C)
Hat_AIR
NDBO_AIR
NDBO_SEA
Date/Time


1979
April
May
1
5
10
15
20
25
1
2.0
0
6.0
dyne/cm²
Hat
Stress
NDBO
P (mb)
Hat
NDBO
T (°C)
Hat_AIR
NDBO_AIR
NDBO_SEA
Date/Time


1979
May
June
1
5
10
15
20
25
30
1
2.0
0
6.0
dyne/cm²
Hat
NDBO
Stress
4
2
0
−2
P (mb)
1100
1050
1000
950
Hat
NDBO
T (°C)
30
20
10
0
Hat$_{AIR}$
NDBO$_{AIR}$
NDBO$_{SFC}$
May
1979
June
Date/Time

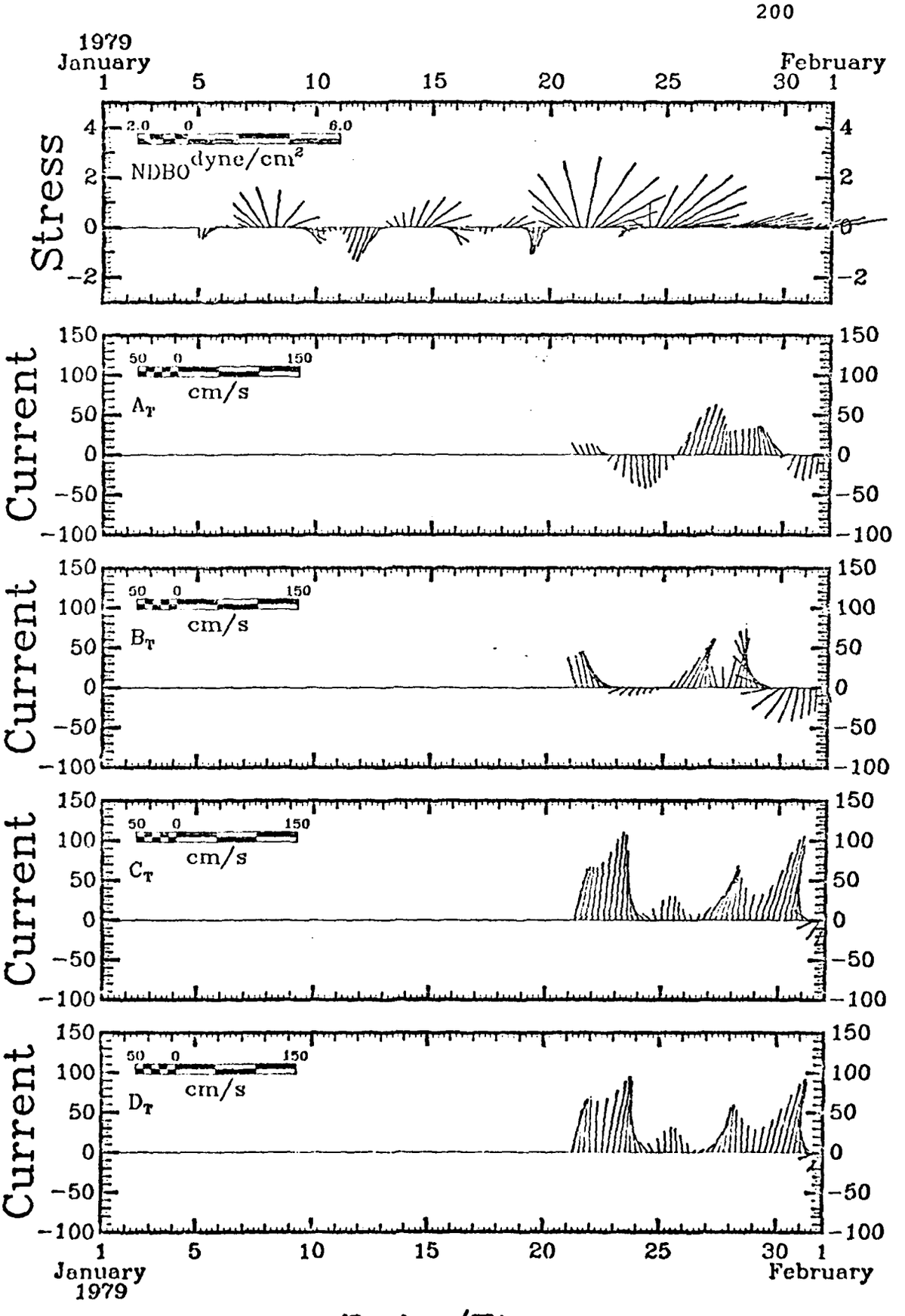

1979
June
July
1
5
10
15
20
25
1
2.0
0
6.0
dyne/cm²
Hat
Stress
4
2
0
−2
NDBO
P (mb)
1100
1050
1000
950
Hat
NDBO
T (°C)
30
20
10
0
Hat AIR
NDBO AIR
NDBO CA
Date/Time

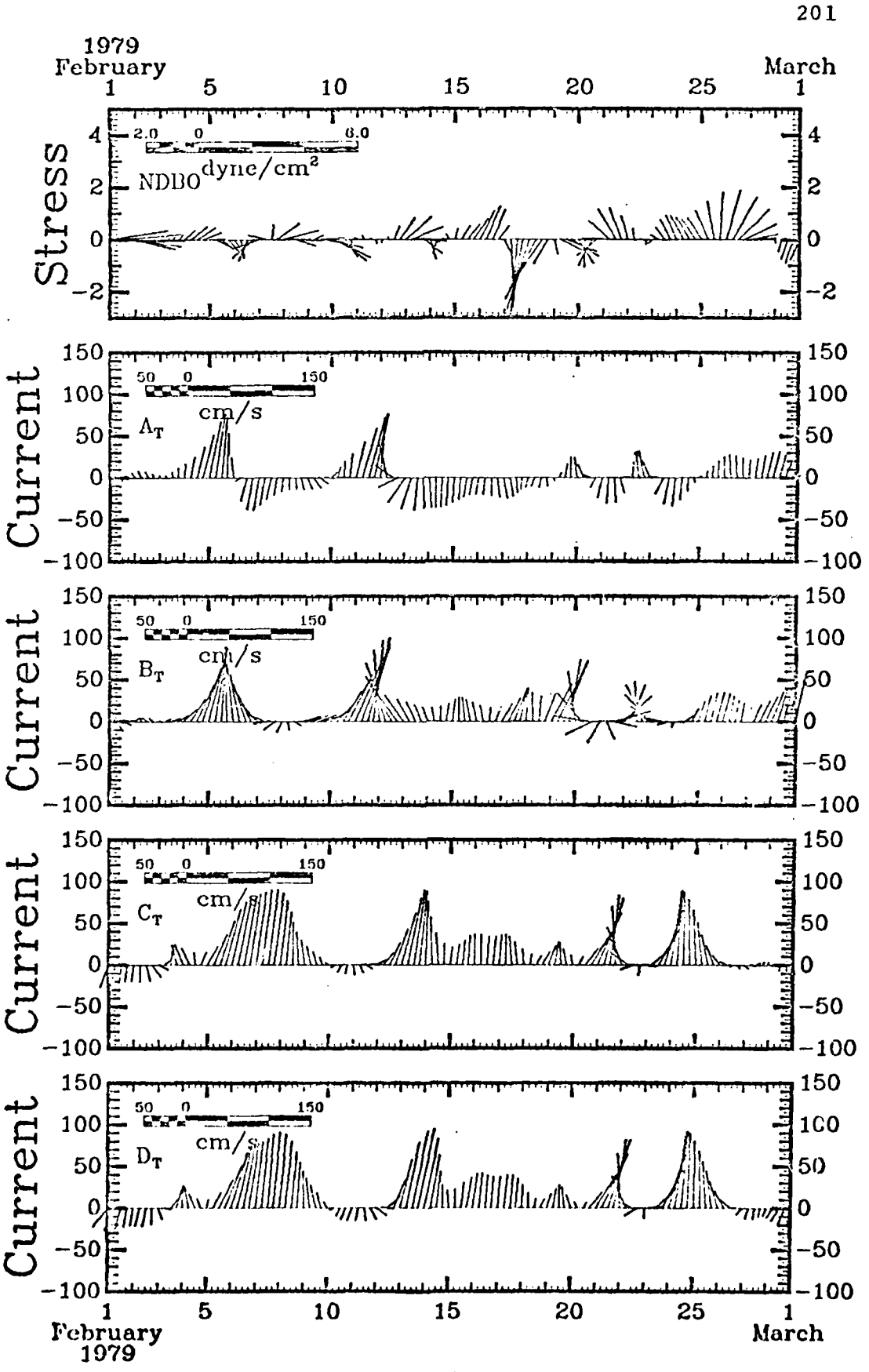

1979
July
August
1
5
10
15
20
25
30
1
2.0
0
8.0
dyne/cm²
Hat
Stress
4
2
0
−2
Stress
Hat
P (mb)
1100
1050
1000
950
Hat$_{AIR}$
T (°C)
30
20
10
0
July
1979
August
Date/Time

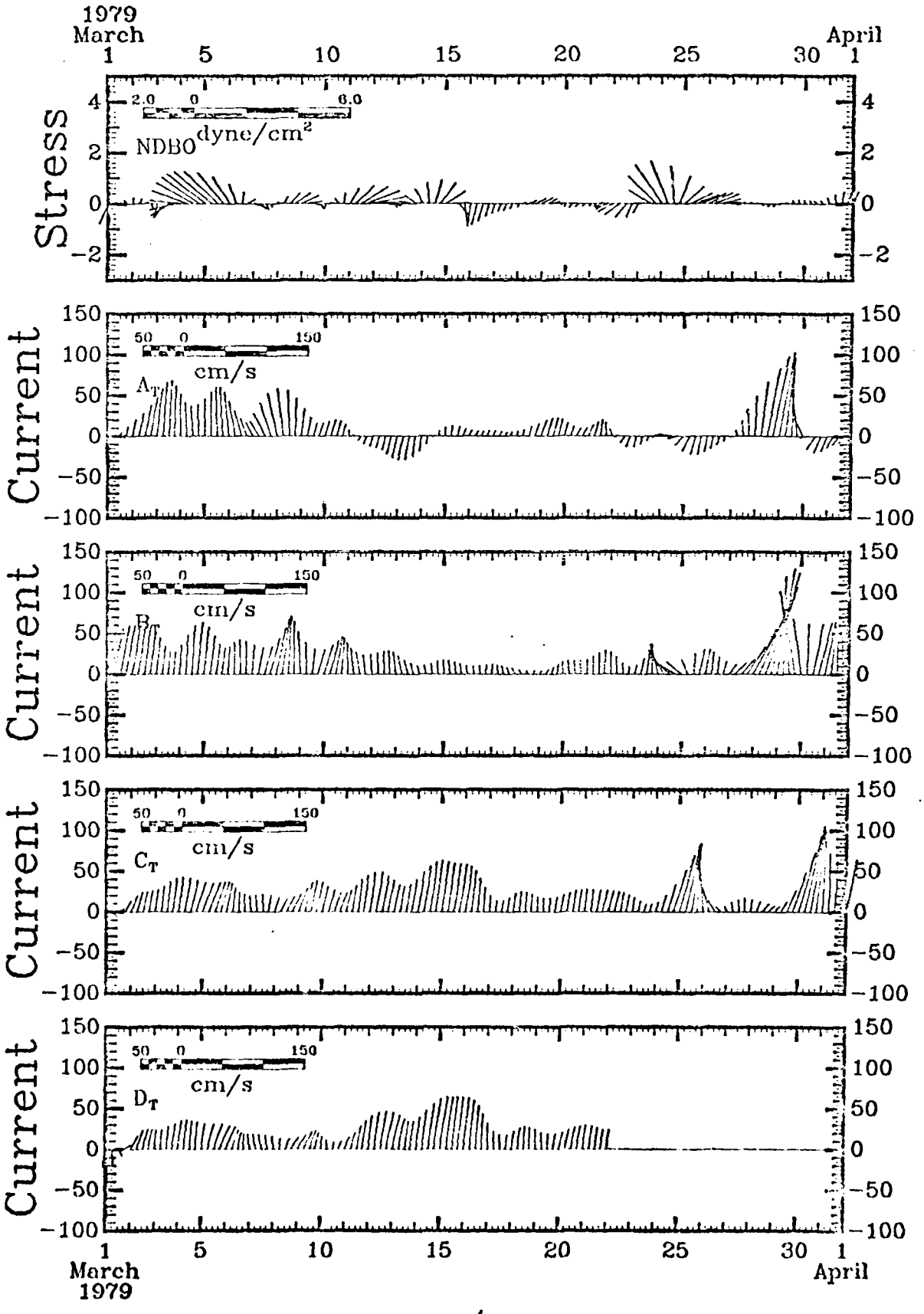
SECTION 8

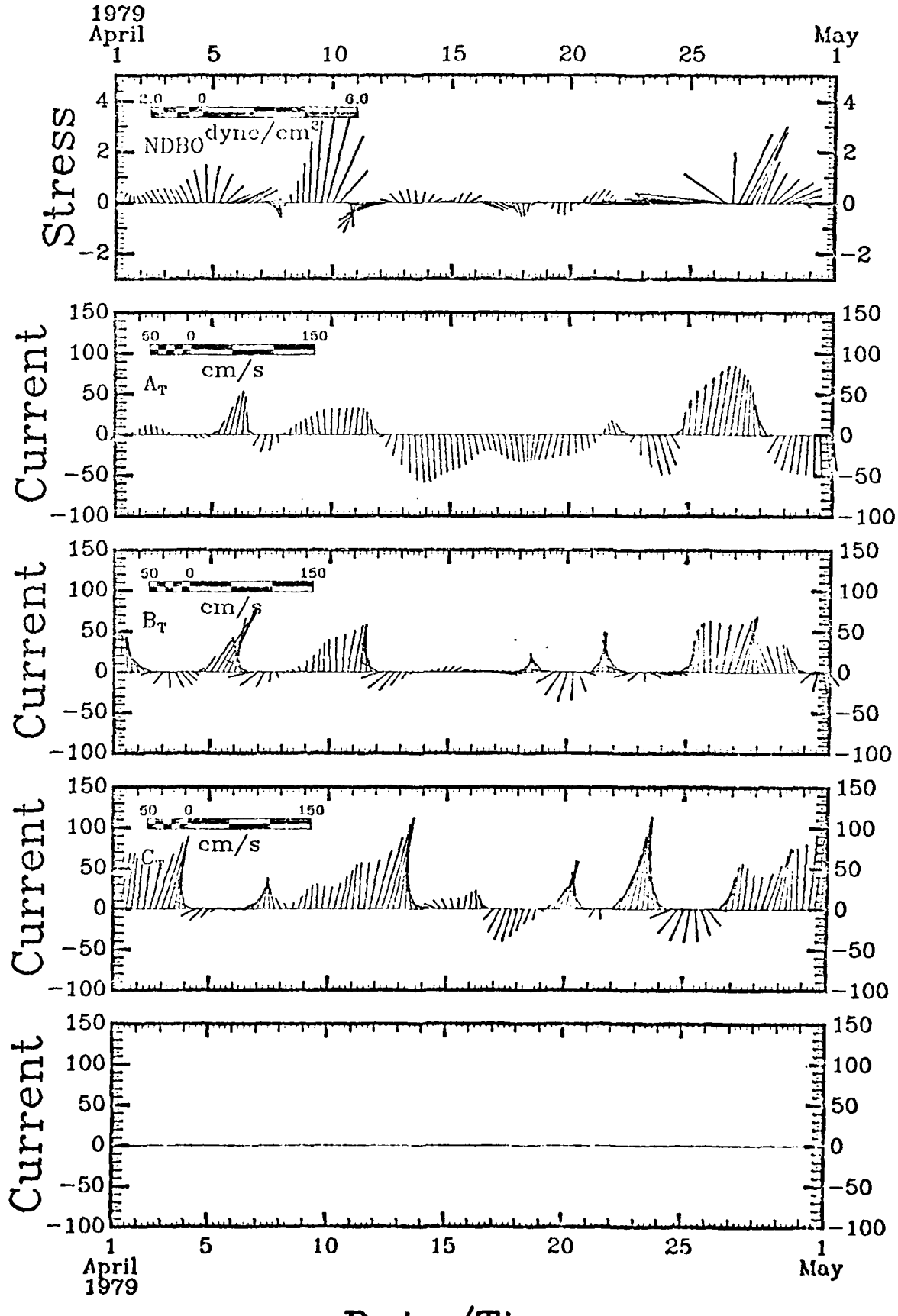
Comparison of 40 HRLP Wind Stress and Current Vector "Sticks"

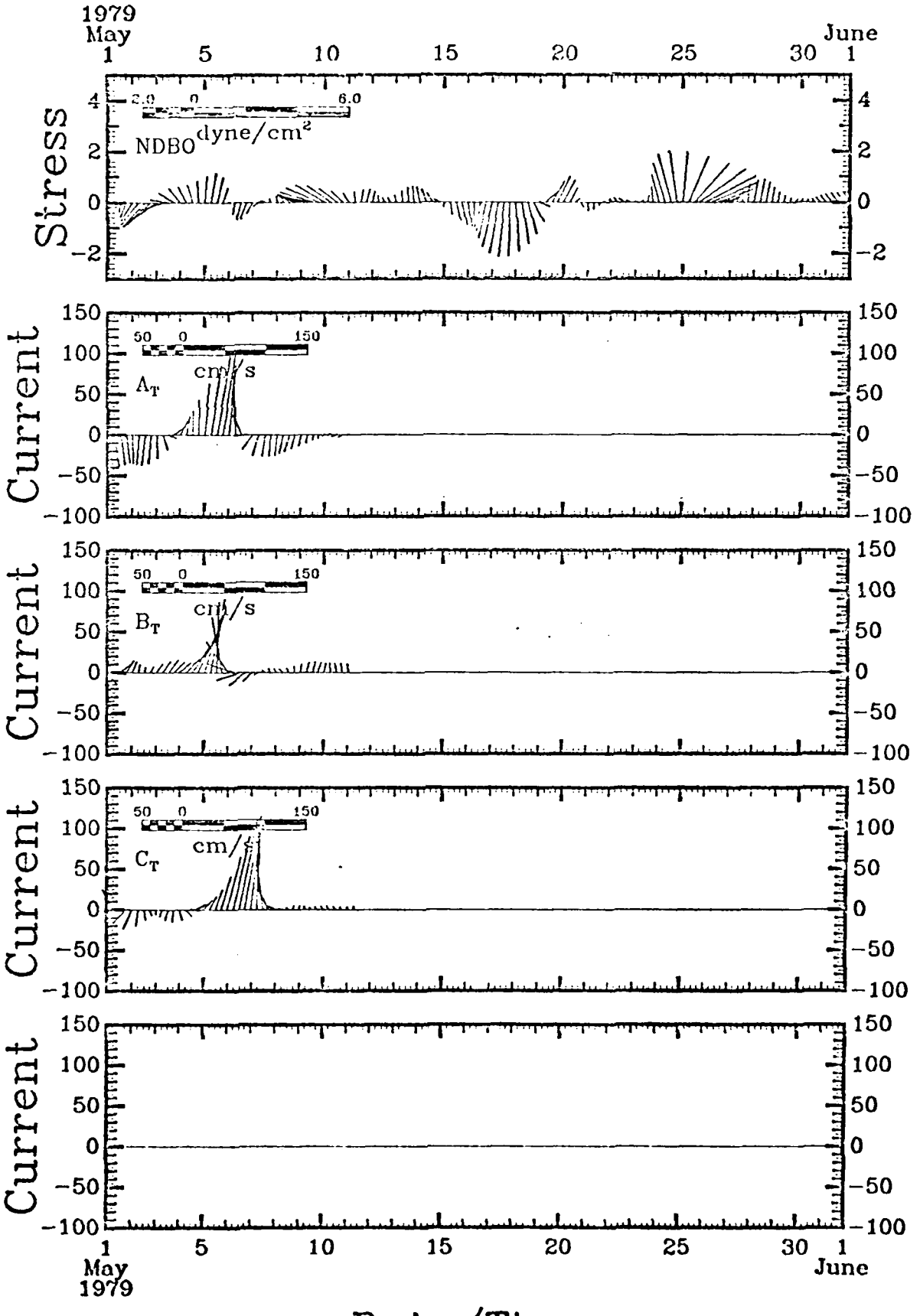
Figure 49 shows by month the 40 HRLP NDBO-4 wind stress vector "sticks" and the 40 HRLP current vector "sticks" for the topmost instrument on each mooring. Vectors pointing toward the top of the page correspond to flow in the downstream (34°T) direction. Common scaling is used in this section. Very little correlation is evident between the wind stress and currents.

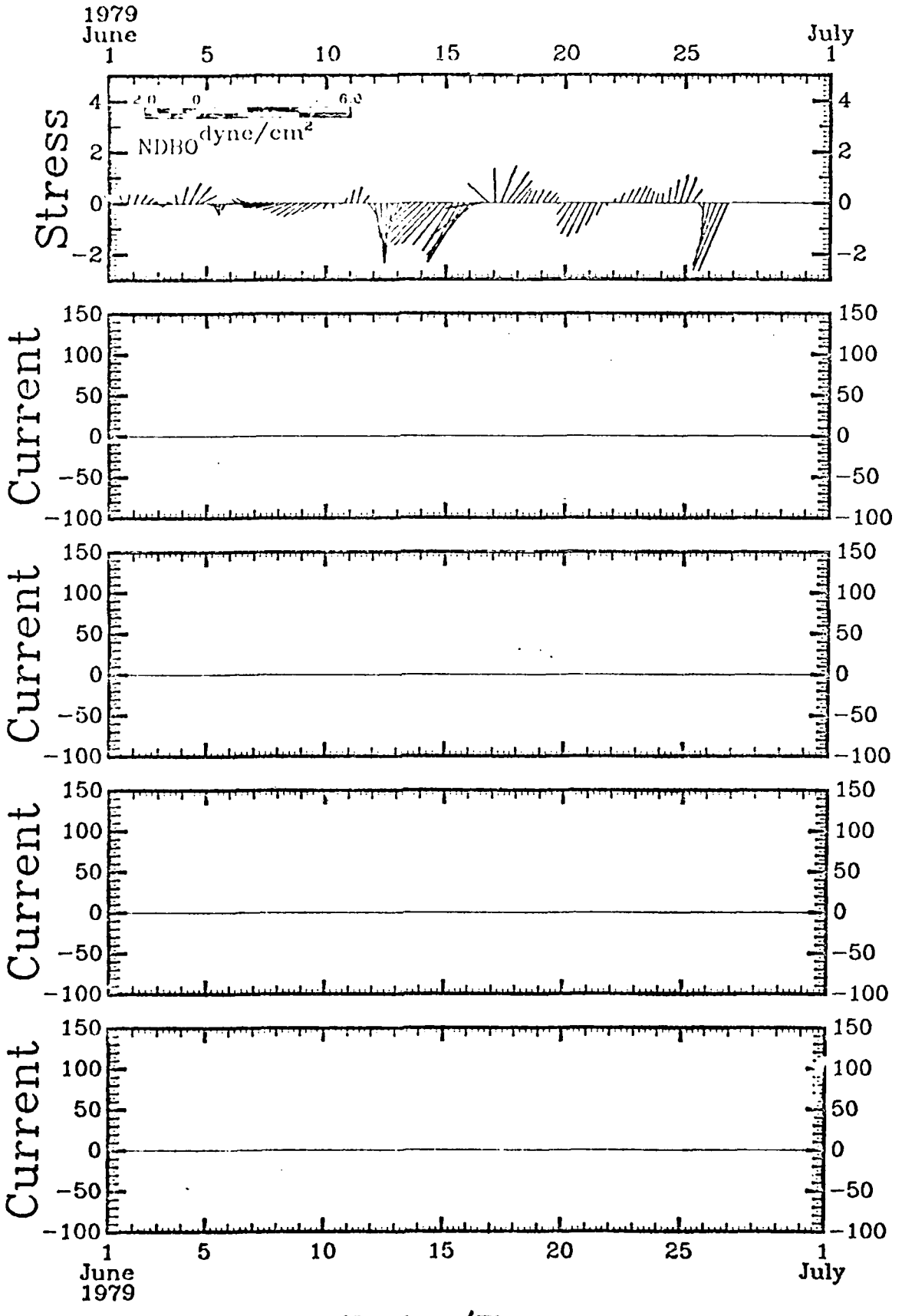

1979
January
February
1 5 10 15 20 25 30 1
Stress
NDBO
dyne/cm²
Current
A_T
B_T
C_T
D_T
cm/s
Date/Time


1979
February
March
1
5
10
15
20
25
1
Stress
2.0
0
6.0
NDBO
dyne/cm²
4
2
0
−2
Current
50
0
150
cm/s
A_T
B_T
C_T
D_T
150
100
50
0
−50
−100
Date/Time


1979
March
April
1 5 10 15 20 25 30 1
Stress
NDBO
dyne/cm²
2.0 0 6.0
Current
cm/s
50 0 150
A_T
B_T
C_T
D_T
150 100 50 0 −50 −100
1 5 10 15 20 25 30 1
March
1979
April
Date/Time


1979
April
May
1
5
10
15
20
25
1
Stress
NDBO
dyne/cm²
-2.0
0
6.0
Current
A_T
B_T
C_T
cm/s
-50
50
100
150
-100
4
2
0
-2
April
1979
May
Date/Time

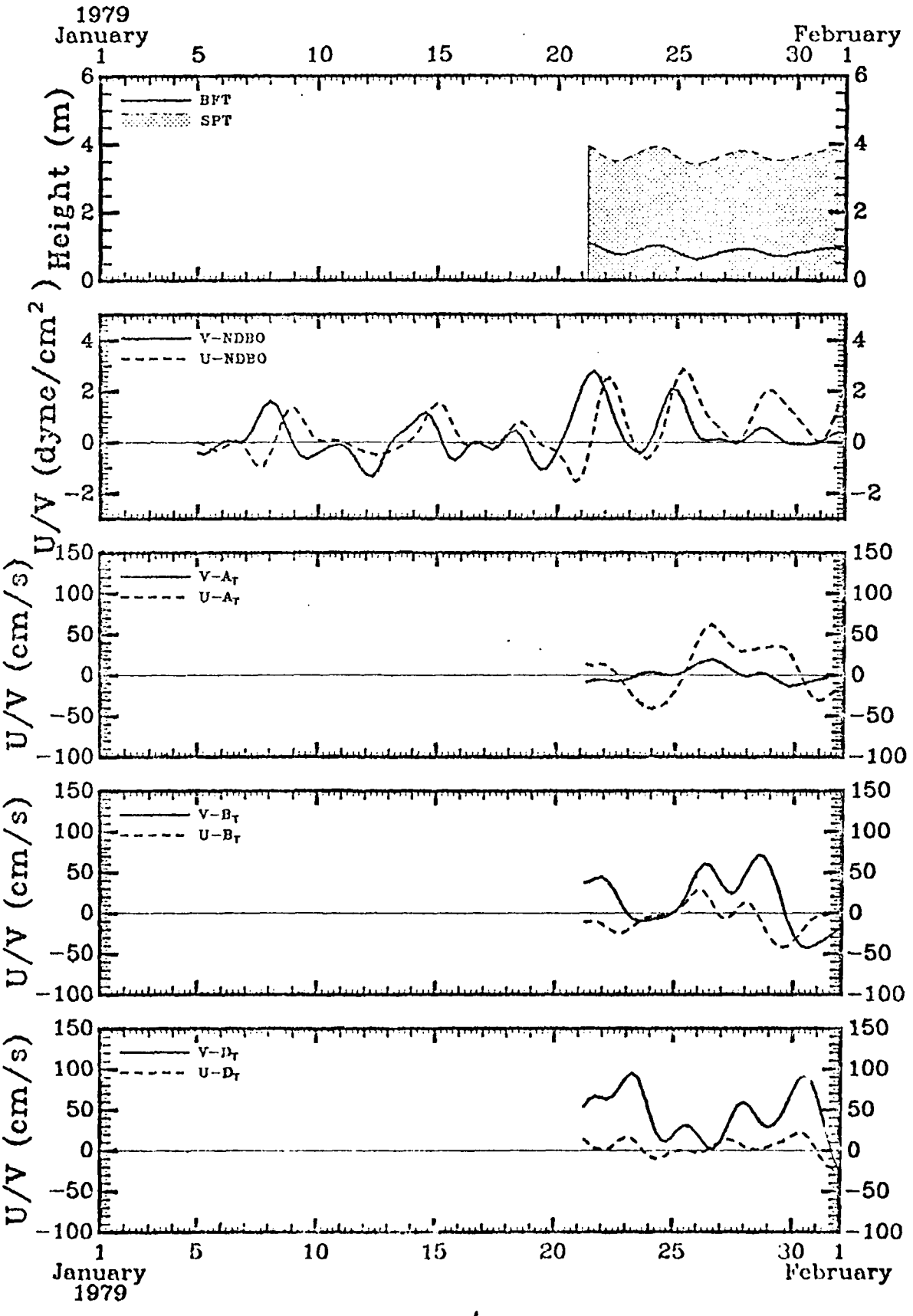

1979
May
June
1
5
10
15
20
25
30
1
Stress
NDBO
dyne/cm²
Current
A_T
B_T
C_T
cm/s
Date/Time

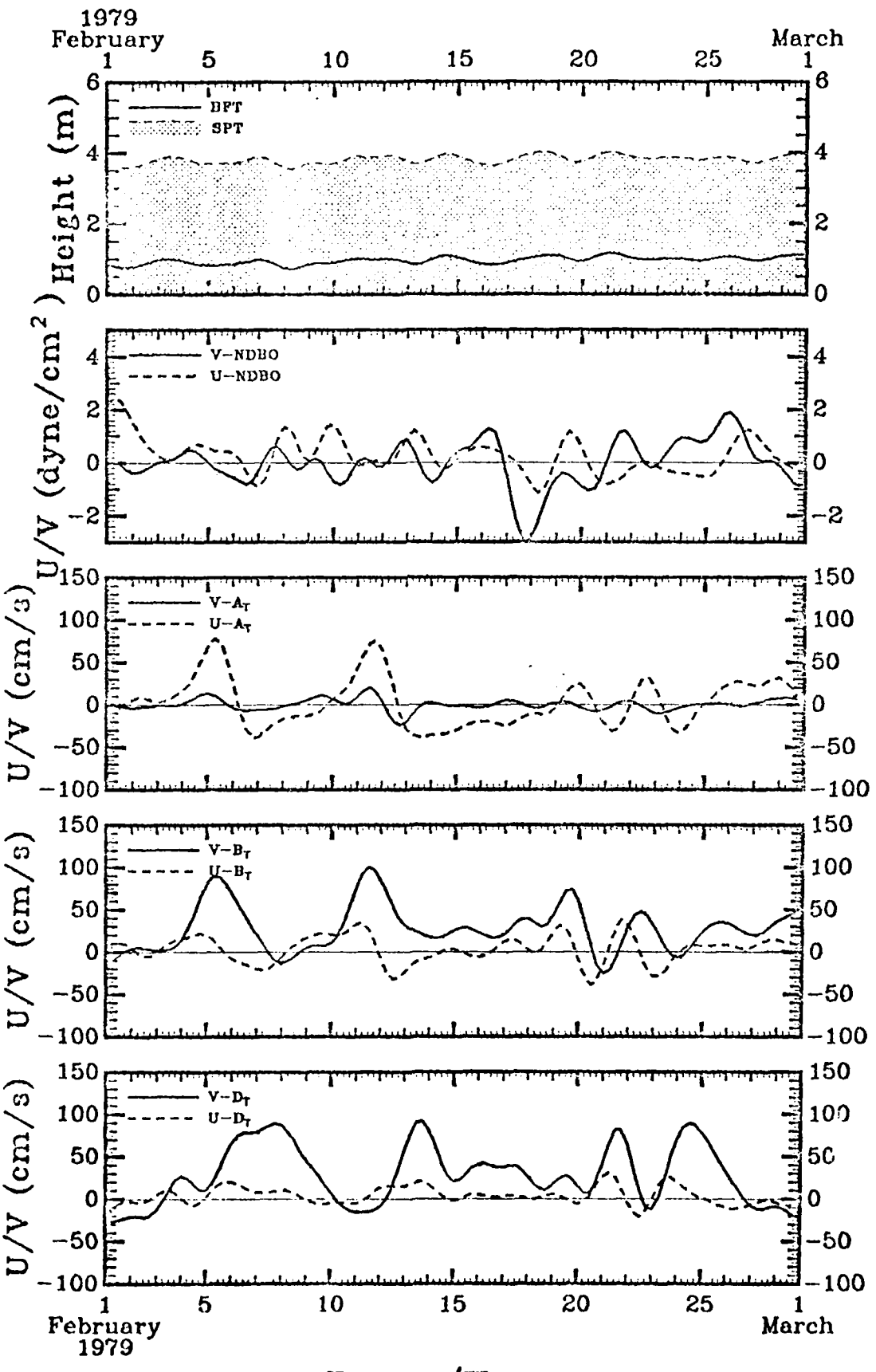

1979
June
1
5
10
15
20
25
July
1
Stress
NDBO dyne/cm²
Current
Current
Current
Current
150
100
50
0
−50
−100
4
2
0
−2
June
1979
July
Date/Time

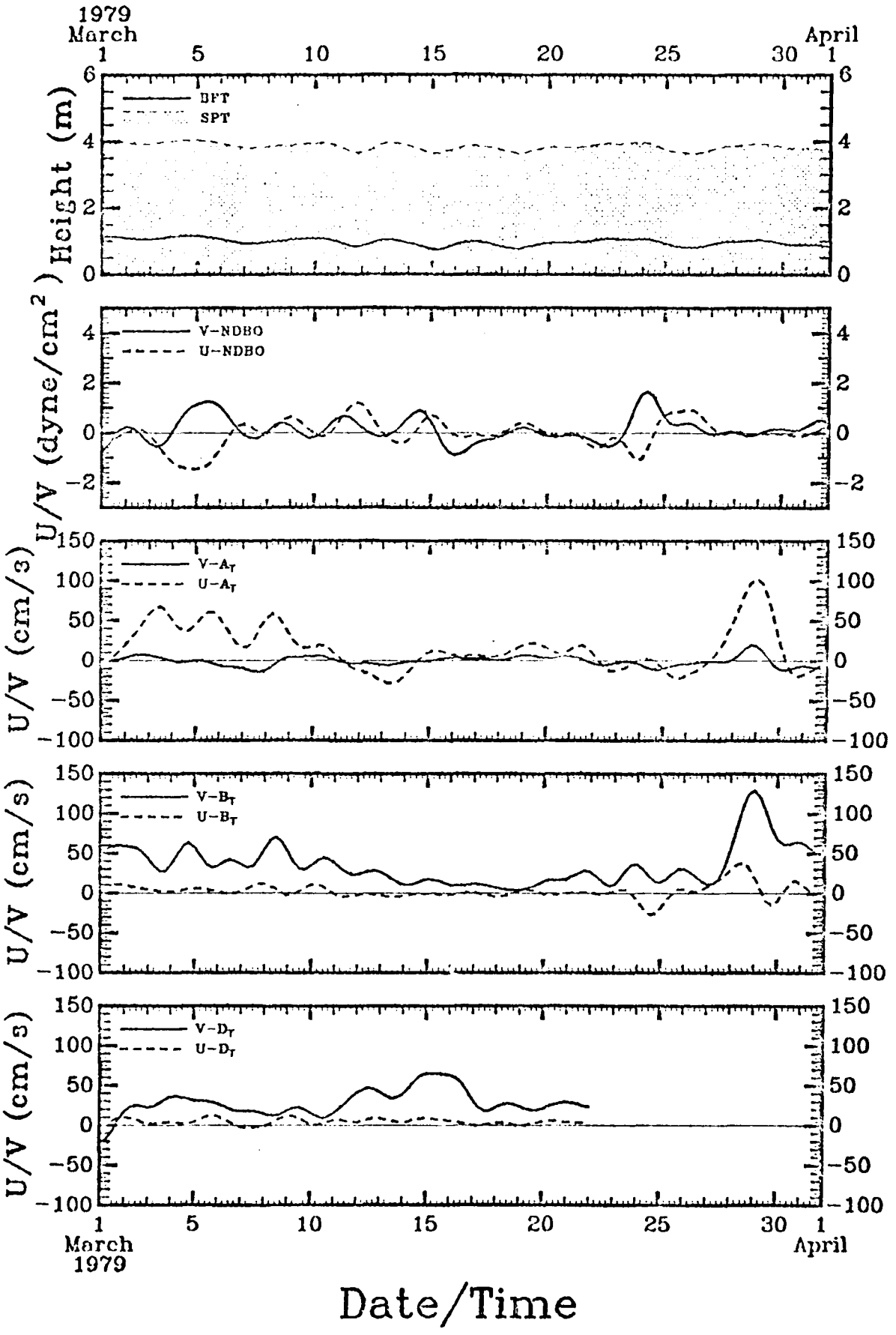
SECTION 9

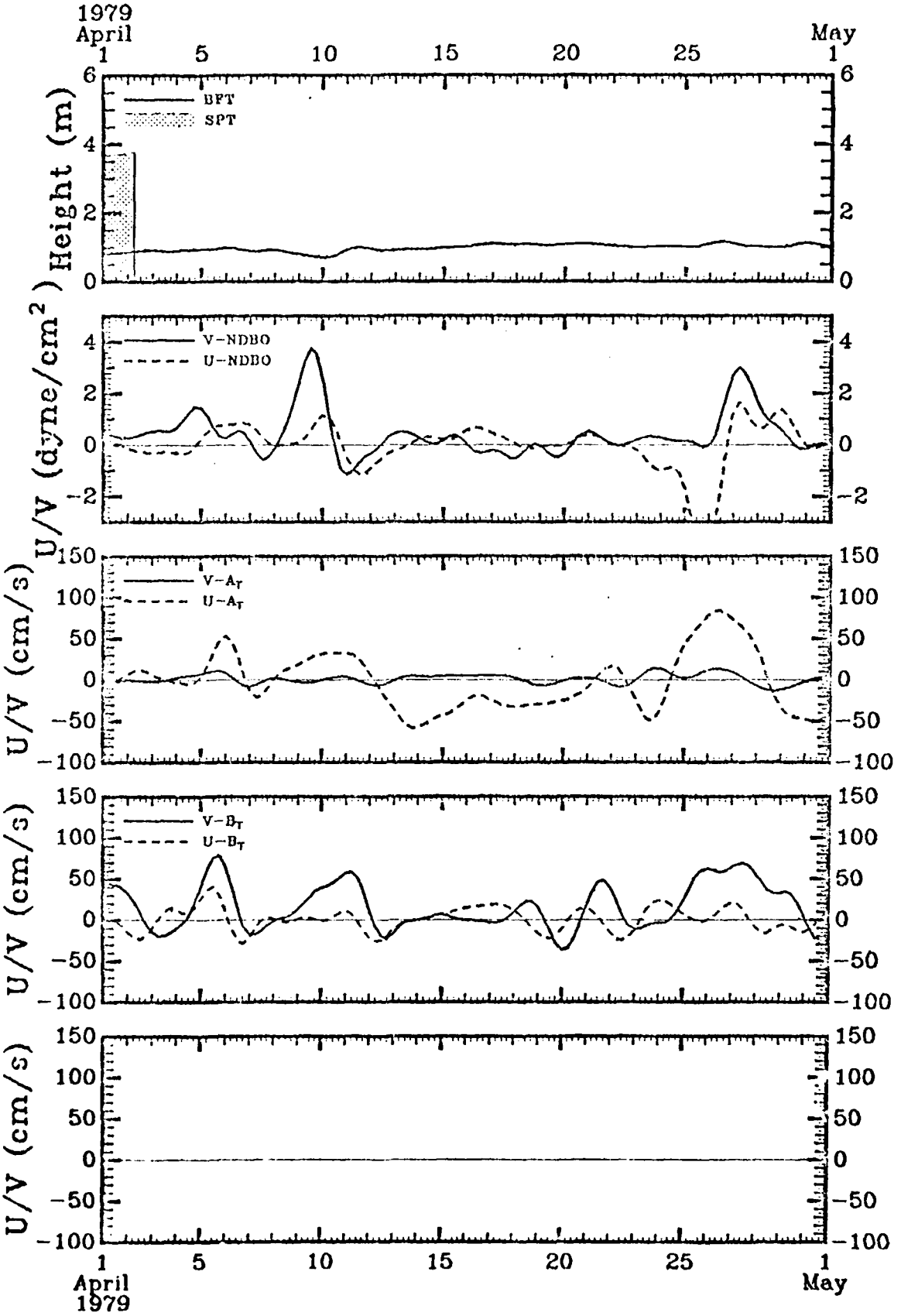
40 HRLP Sea Level Height, Wind Stress, and Current Velocity Components

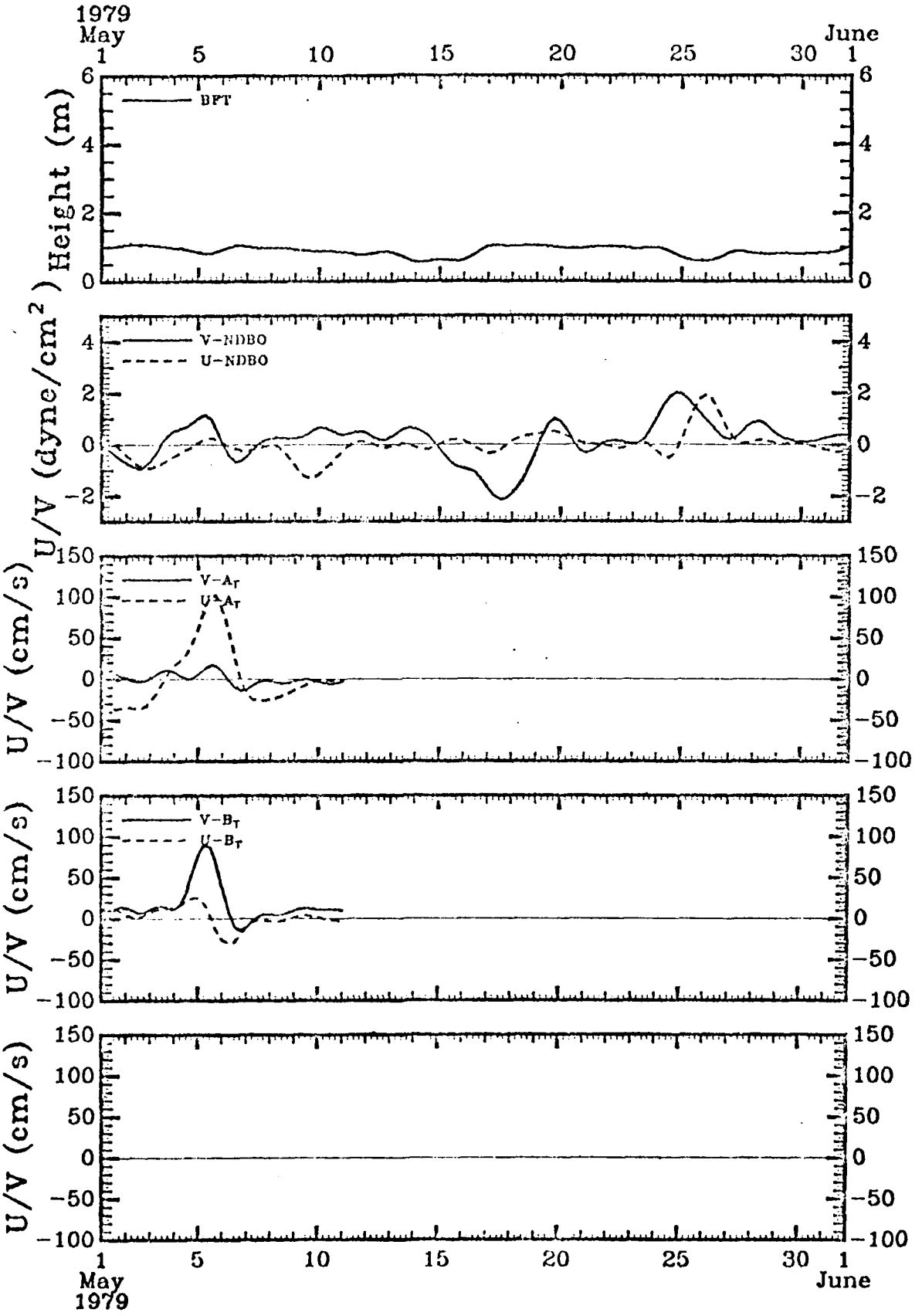
Figure 50 shows by month the adjusted sea level height at Beaufort (BFT) and at Southport (SPT), the u/v (offshore/downstream) components of Hatteras wind stress, and the u/v current vector components at the topmost instruments on the A, B and D moorings.


1979
January
February
1 5 10 15 20 25 30 1
Height (m)
BFT
SPT
U/V (dyne/cm²)
V-NDBO
U-NDBO
U/V (cm/s)
V-A_T
U-A_T
V-B_T
U-B_T
V-D_T
U-D_T
1 5 10 15 20 25 30 1
January
1979
February
Date/Time


1979
February
March
1
5
10
15
20
25
1
Height (m)
BPT
SPT
U/V (dyne/cm²)
V-NDBO
U-NDBO
U/V (cm/s)
V-A_T
U-A_T
V-B_T
U-B_T
V-D_T
U-D_T
Date/Time


1979
March
April
1
5
10
15
20
25
30
1
Height (m)
BFT
SPT
U/V (dyne/cm²)
V-NDBO
U-NDBO
U/V (cm/s)
V-A_T
U-A_T
V-B_T
U-B_T
V-D_T
U-D_T
Date/Time


1979
April
May
1
5
10
15
20
25
1
BPT
SPT
Height (m)
V-NDBO
U-NDBO
U/V (dyne/cm²)
V-A_T
U-A_T
U/V (cm/s)
V-B_T
U-B_T
U/V (cm/s)
U/V (cm/s)
1
April
1979
5
10
15
20
25
1
May
Date/Time


1979
May
June
1
5
10
15
20
25
30
1
BPT
Height (m)
V-NDBO
U-NDBO
U/V (dyne/cm²)
V-A_T
U-A_T
U/V (cm/s)
V-B_T
U-B_T
U/V (cm/s)
U/V (cm/s)
May
1979
June
Date/Time

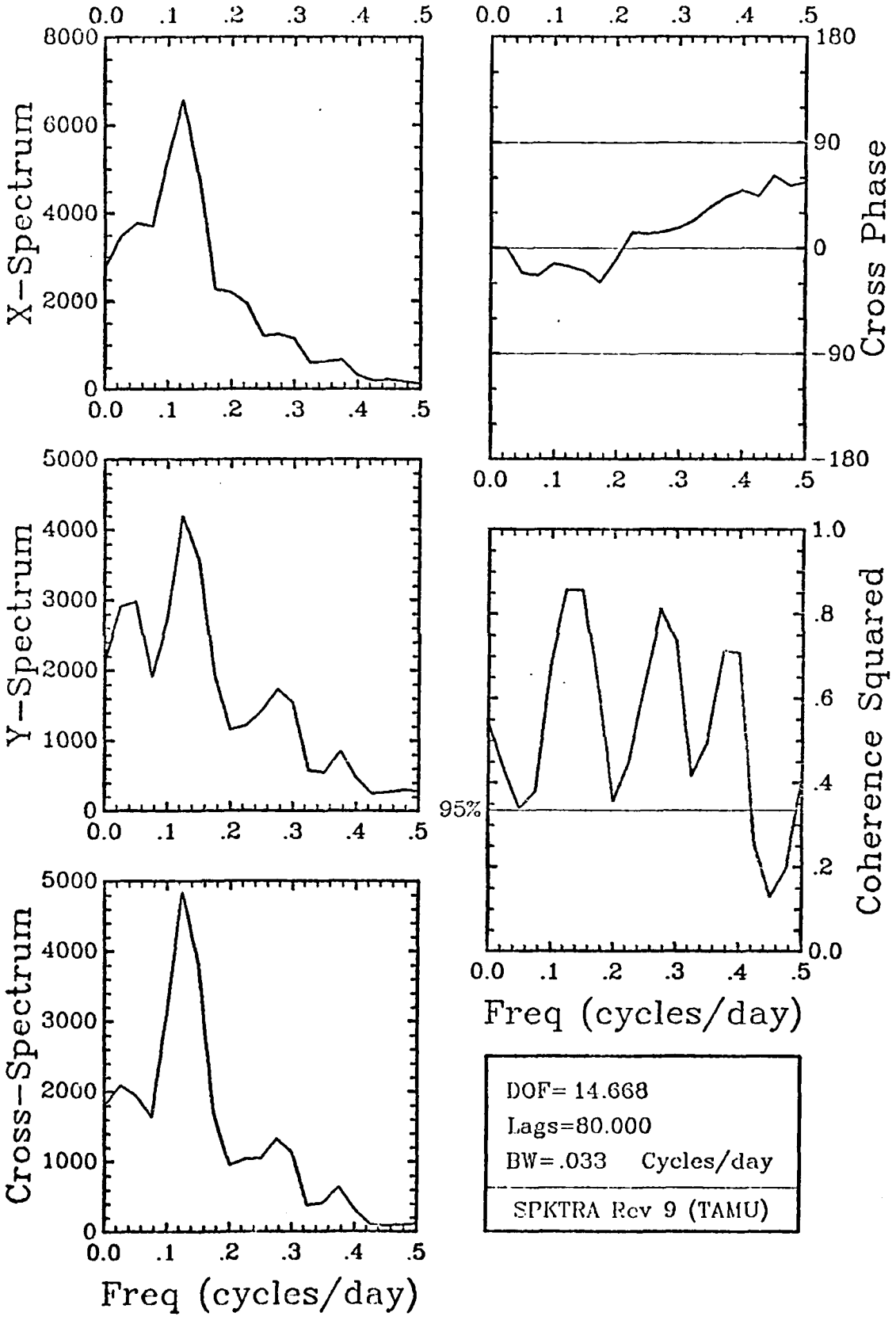
SECTION 10

Spectrum Calculations for Various Combinations of 40 HRLP Data Sets

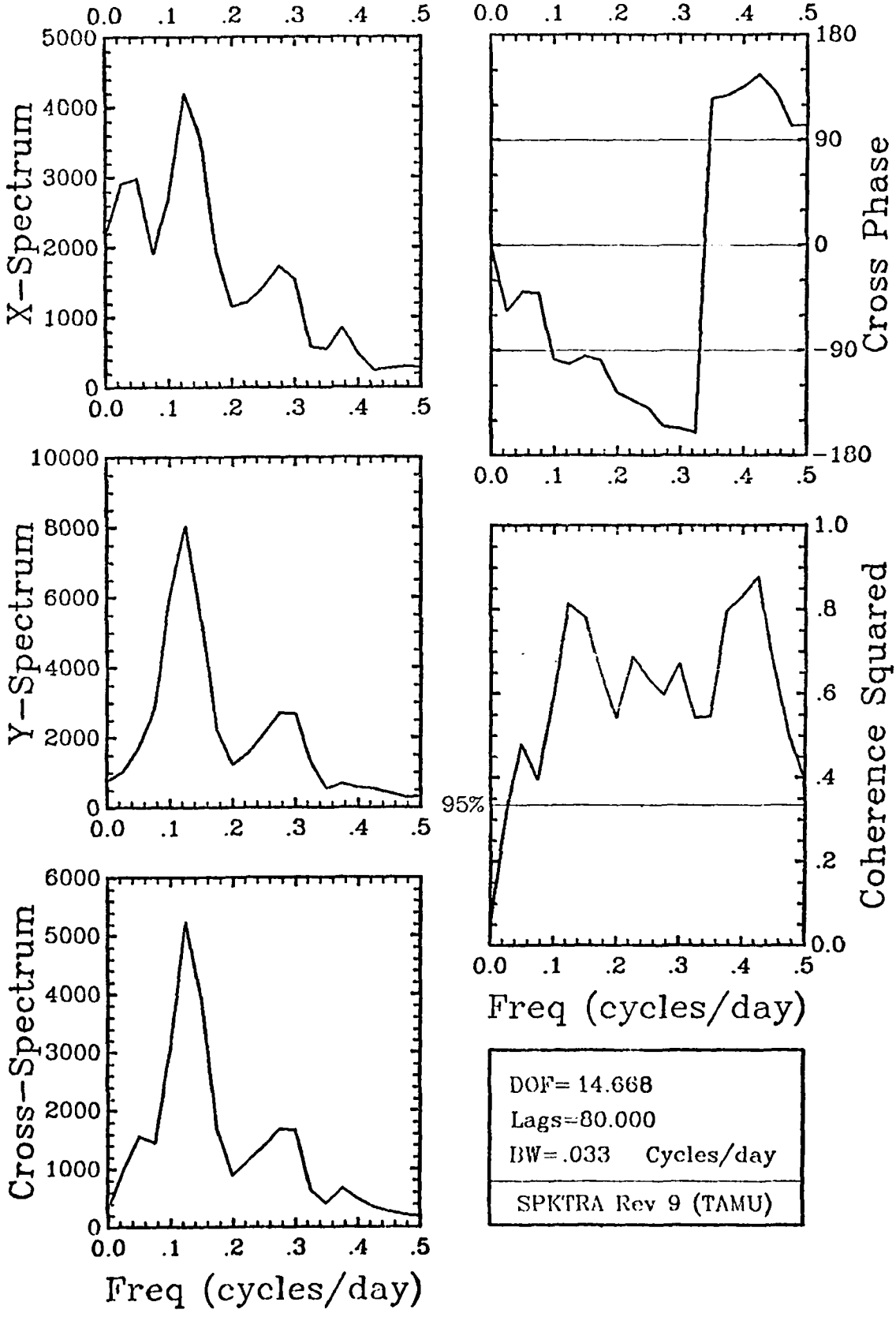
Figures 51 through 98 show spectrum, cross-spectrum, phase, and coherence squared calculations for selected pairs of 40 HRLP current components, Hatteras and NDBO wind stress components, "adjusted" (barometrically corrected) sea level, and various combinations thereof. The naming convention gives the "X" time series first and the "Y" time series second. Currents are identified by mooring letter, and instrument position on the mooring is given by subscript letter. The phase convention is such that negative phase values mean the "Y" series lags the "X" series. The spectrum ordinate units in all cases are variance units per cycle per day (CPD), where the variance units are those appropriate for the time series in question. Root-mean-square estimates of a variable in a particular frequency band can be obtained by multiplying the spectrum estimate in that band by the effective bandwidth (0.033 CPD in all cases) and taking the square root of the product. The 95% significance level for coherence squared, the level below which would fall 95% of the coherence estimates between truly uncorrelated variates, is shown by a horizontal line on the coherence graphs. Spectrum estimates nominally possess 15 degrees of freedom (DOF), although some variation in this number, accepted in favor of maintaining the bandwidth invariant, results from differing record lengths. For 15 DOF, the 95% confidence interval on the phase

estimate in a particular frequency band is approximately ± (27, 18, 12) degrees for a coherence squared value of (0.4, 0.6, 0.8) in that band.

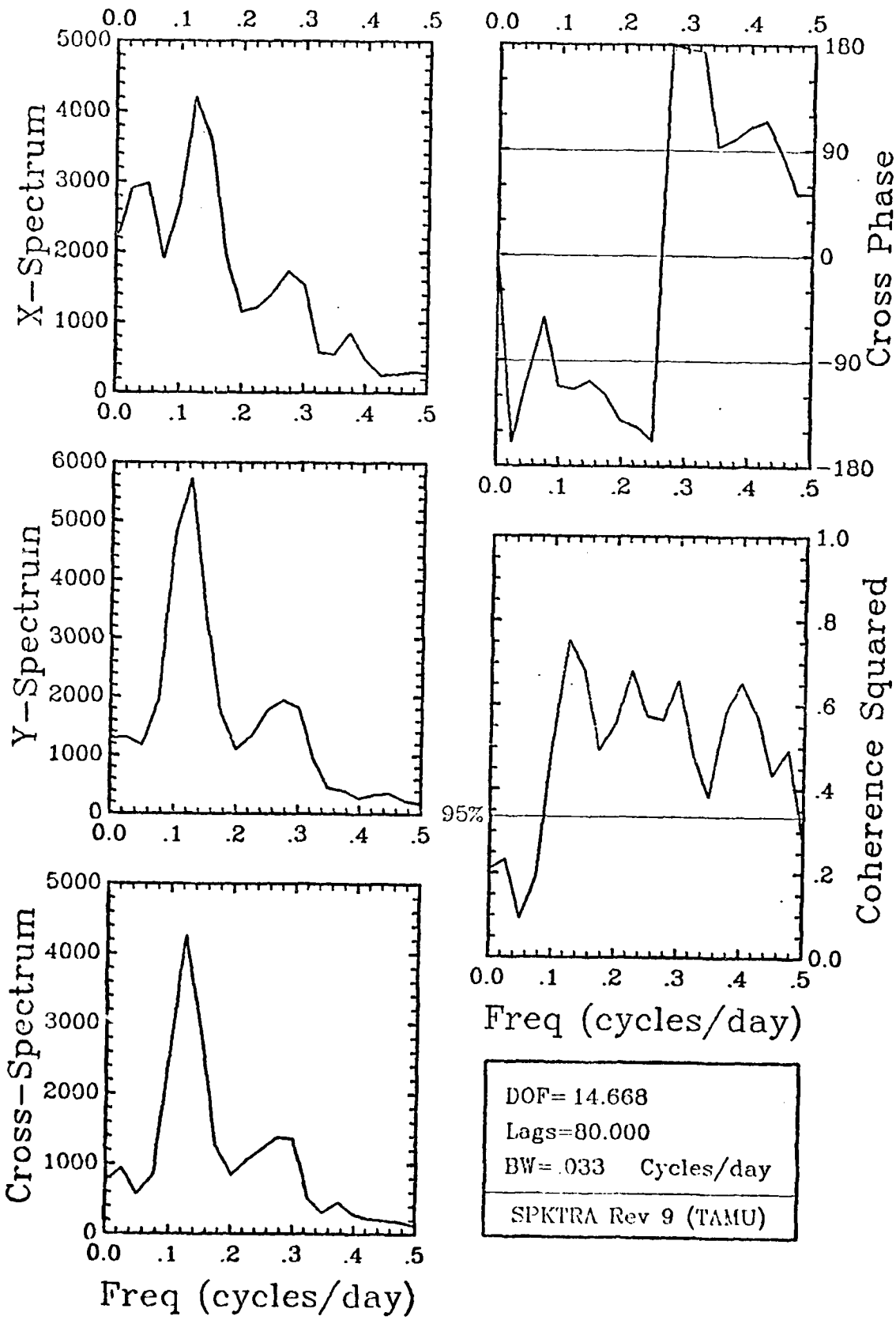
A remarkable feature apparent in this set of figures is the near-independence of the current and wind stress fluctuations for periods longer than several days.



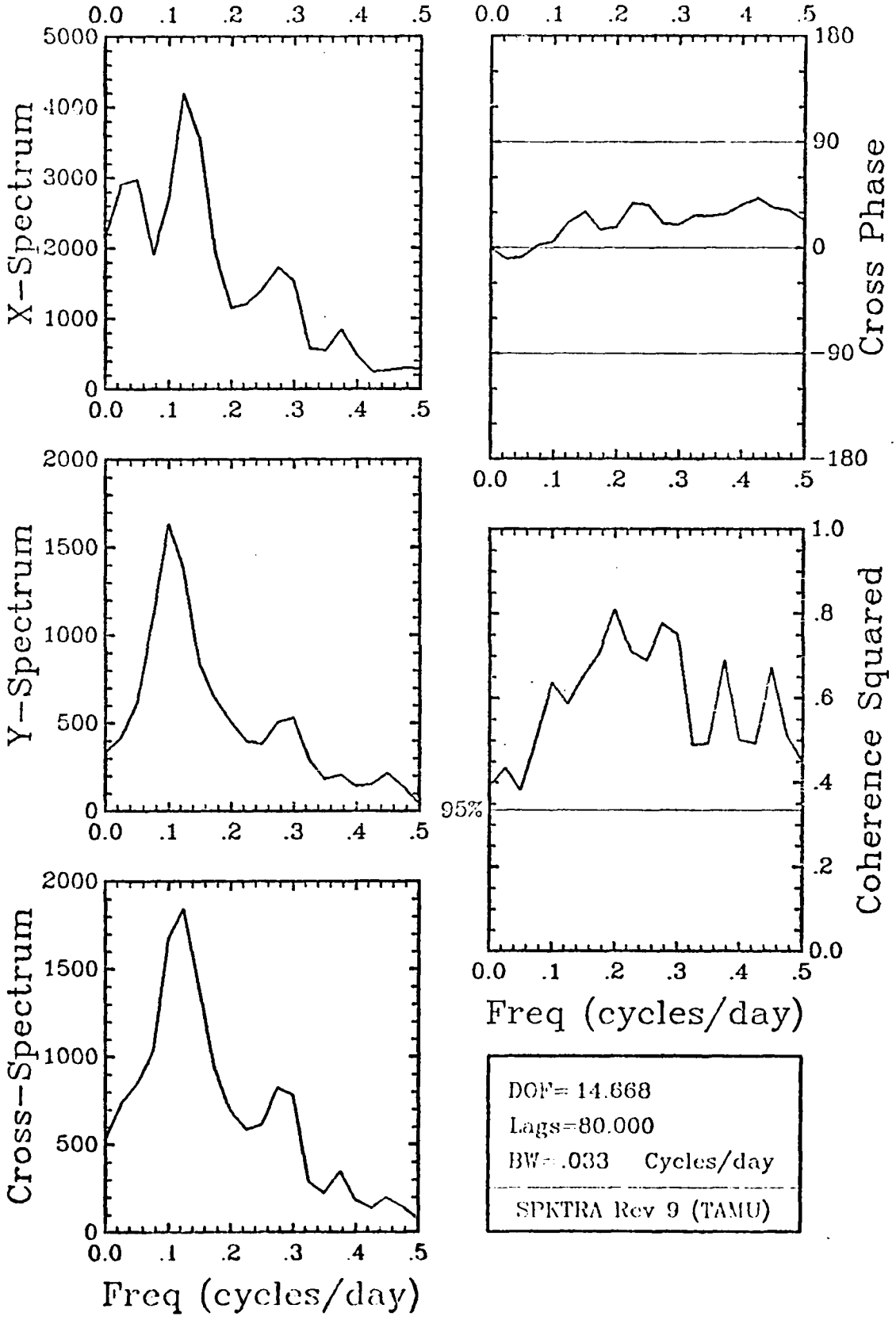
A_TV / B_TV winter 40 HR LP



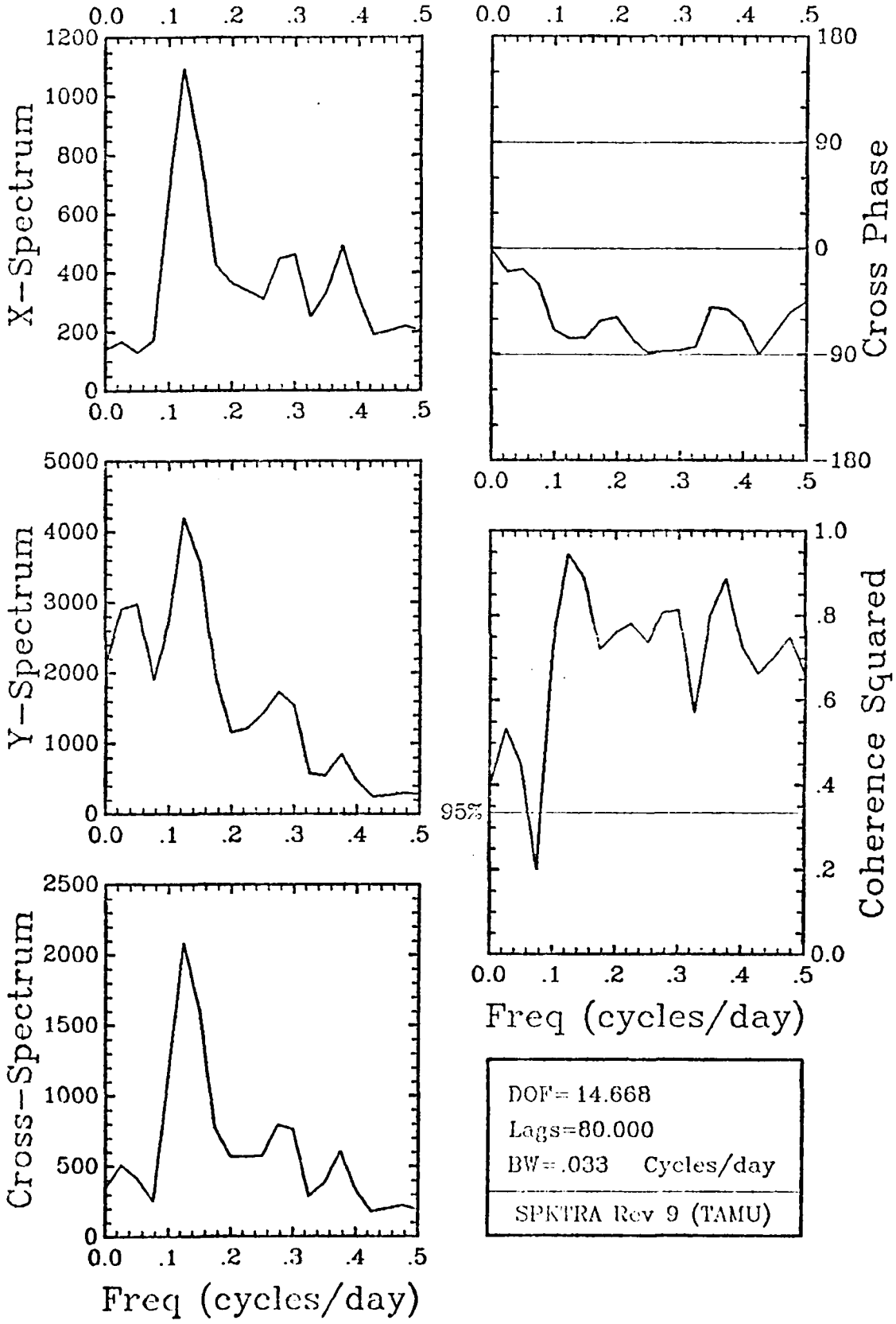
B_TV / C_TV winter 40 HR LP



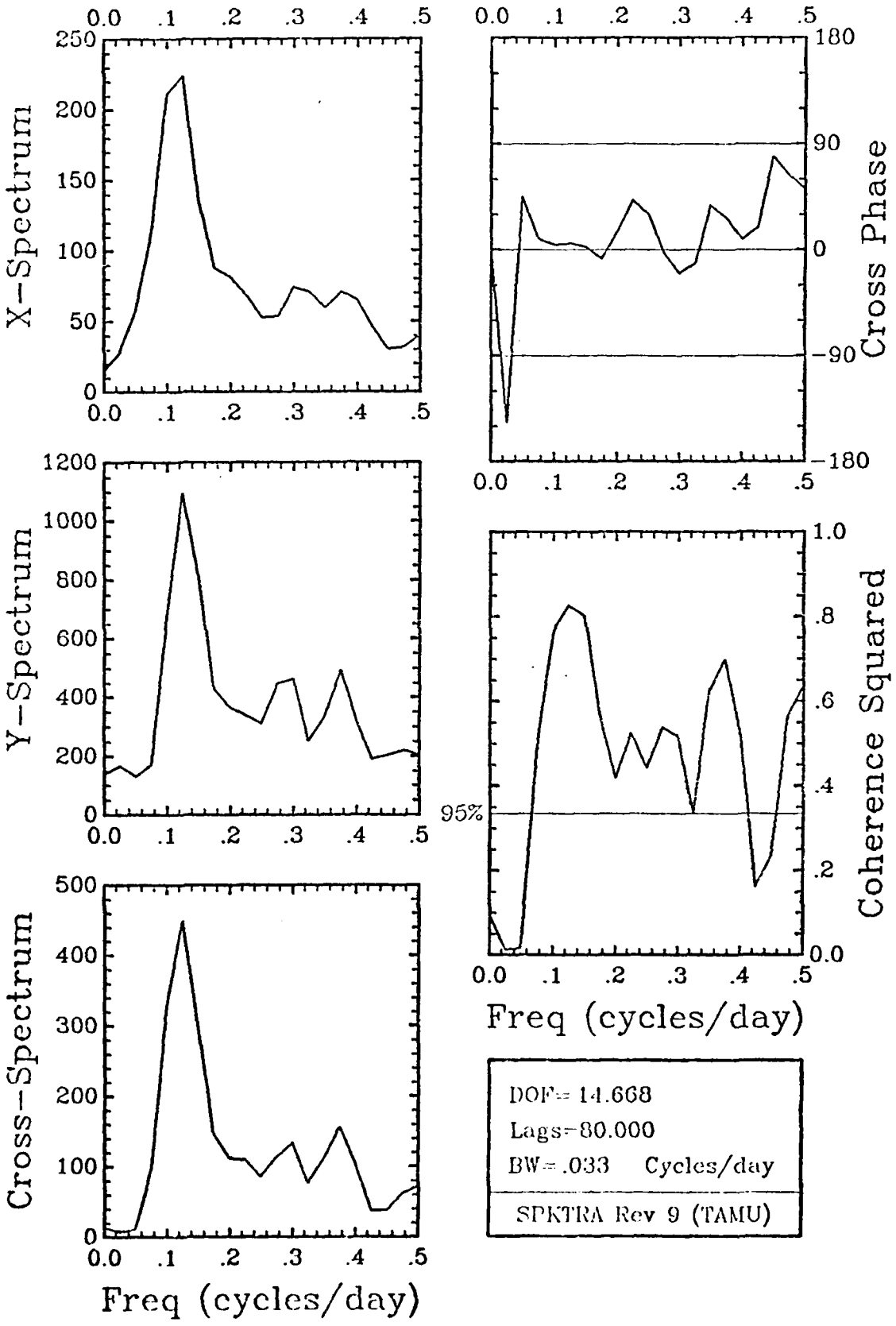
$B_T V$ / $D_M V$ winter 40 HR LP



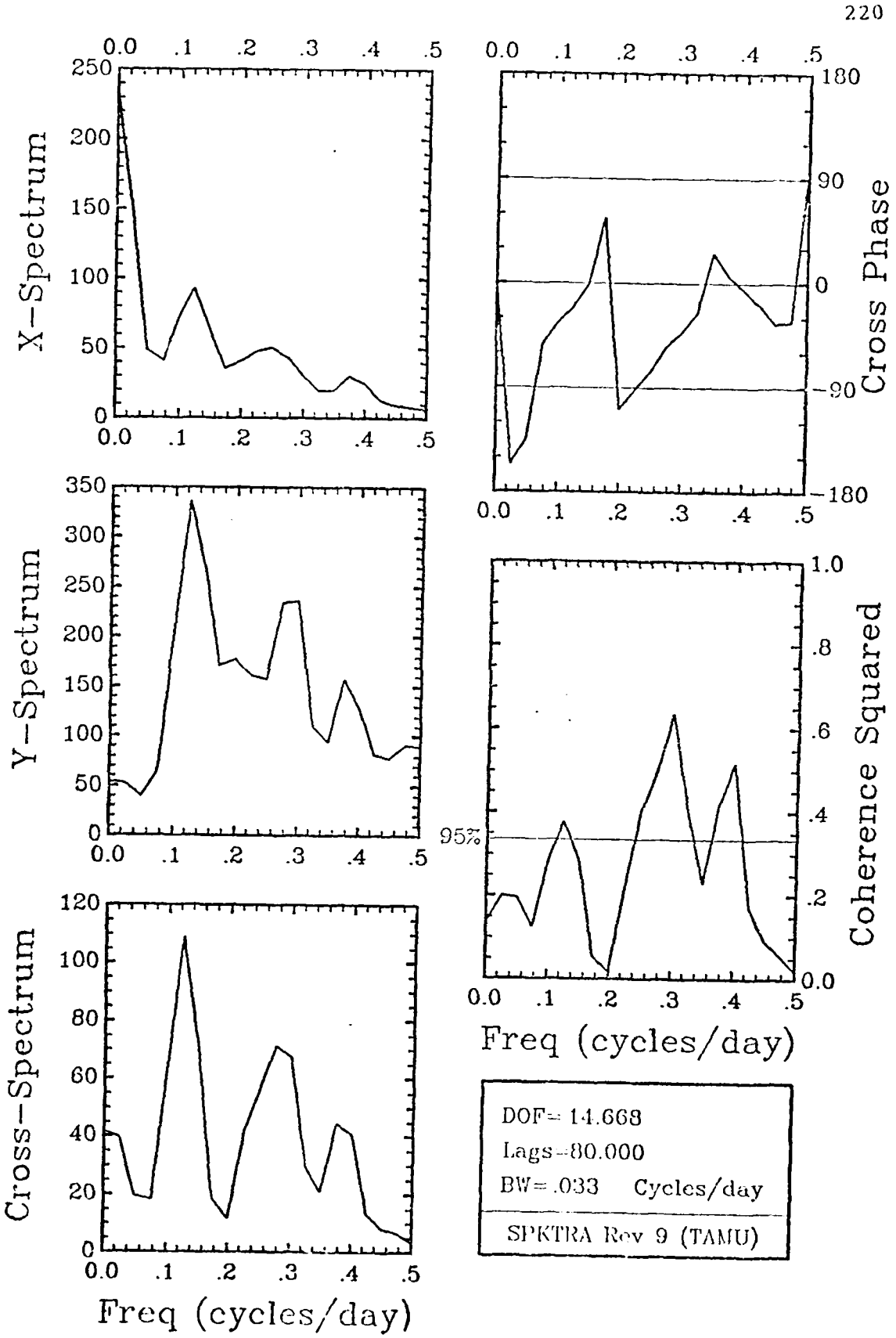
B_TV / B_BV winter 40 HR LP



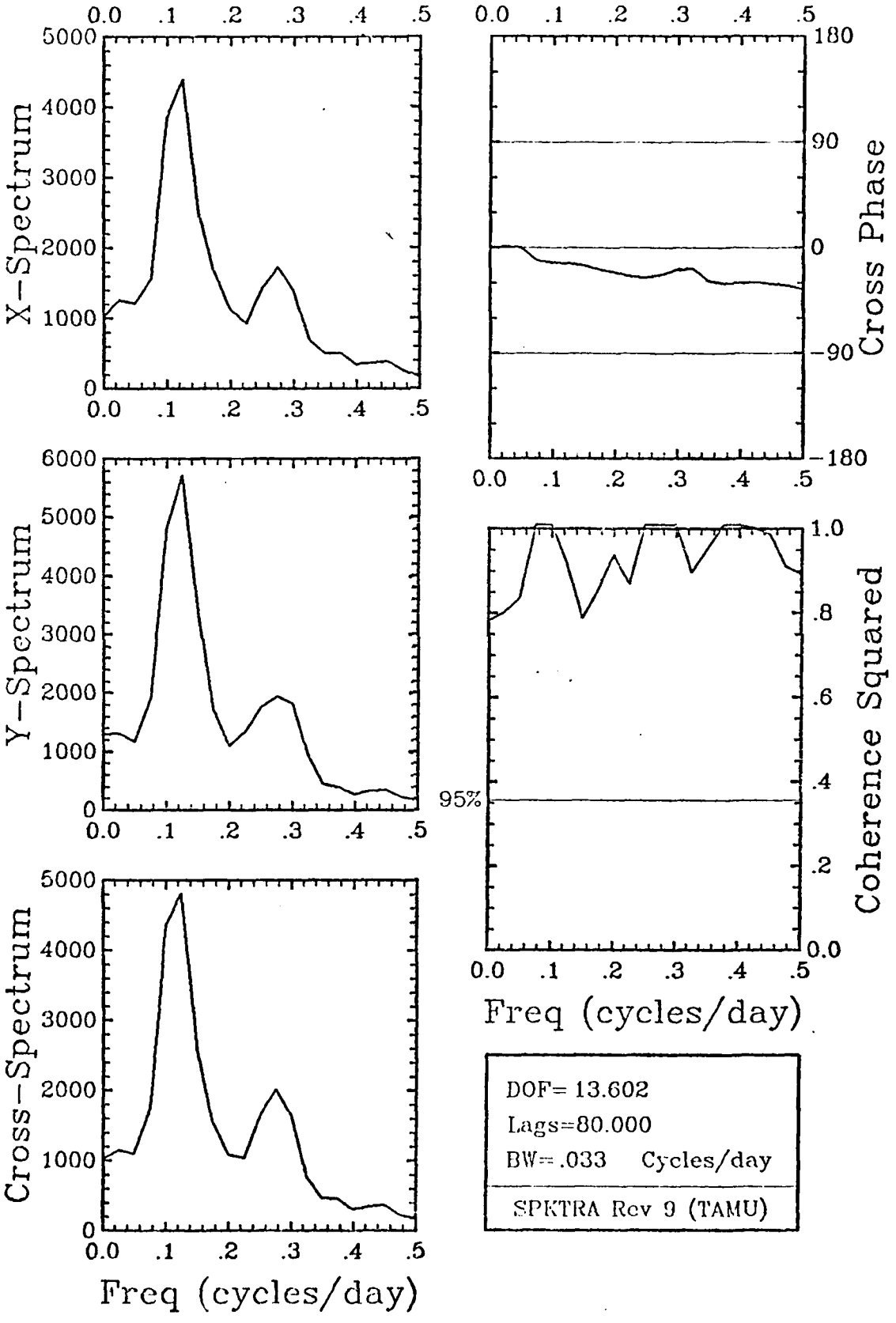
B_TU / B_TV winter 40 HR LP



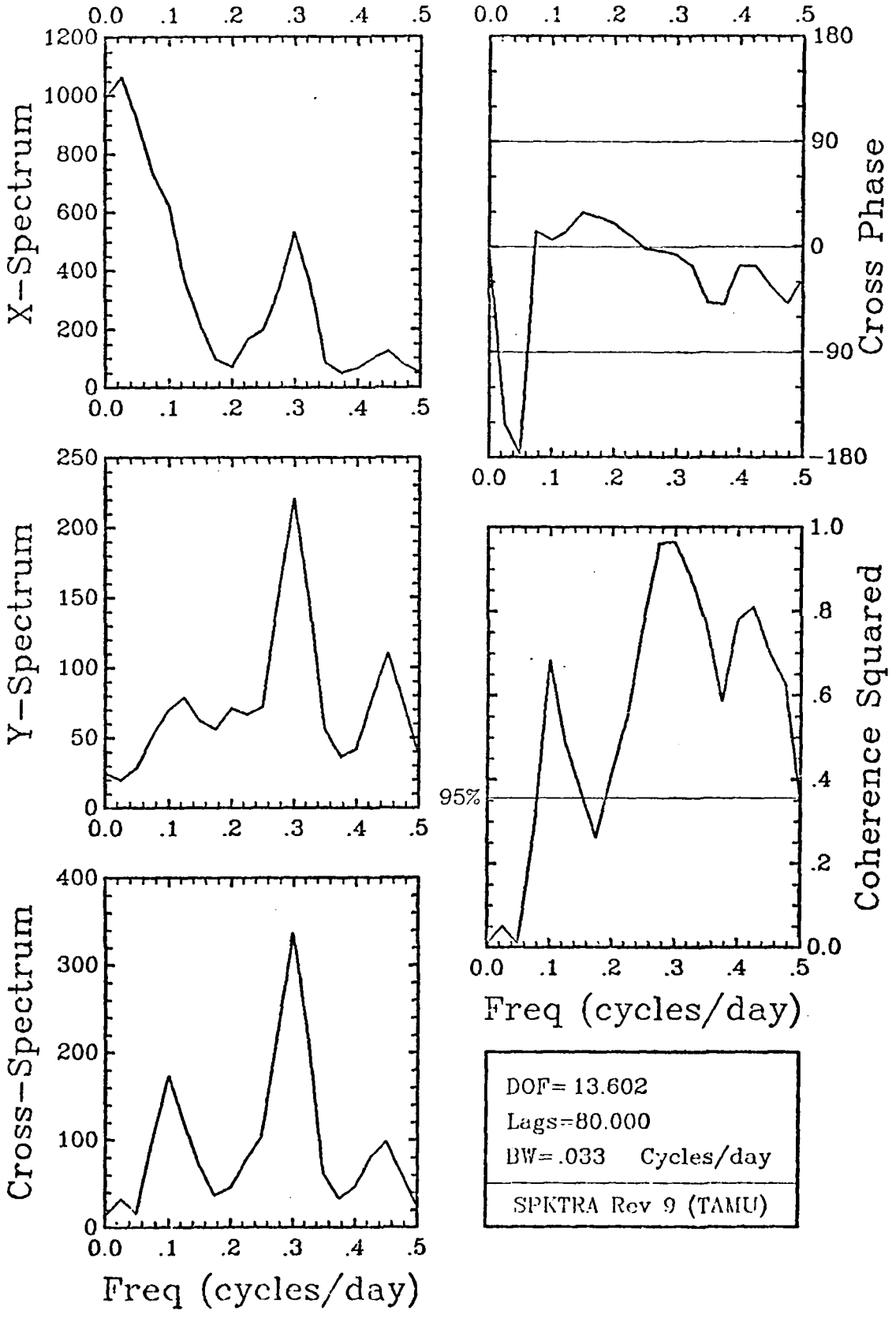
A_TU / B_TU winter 40 HR LP



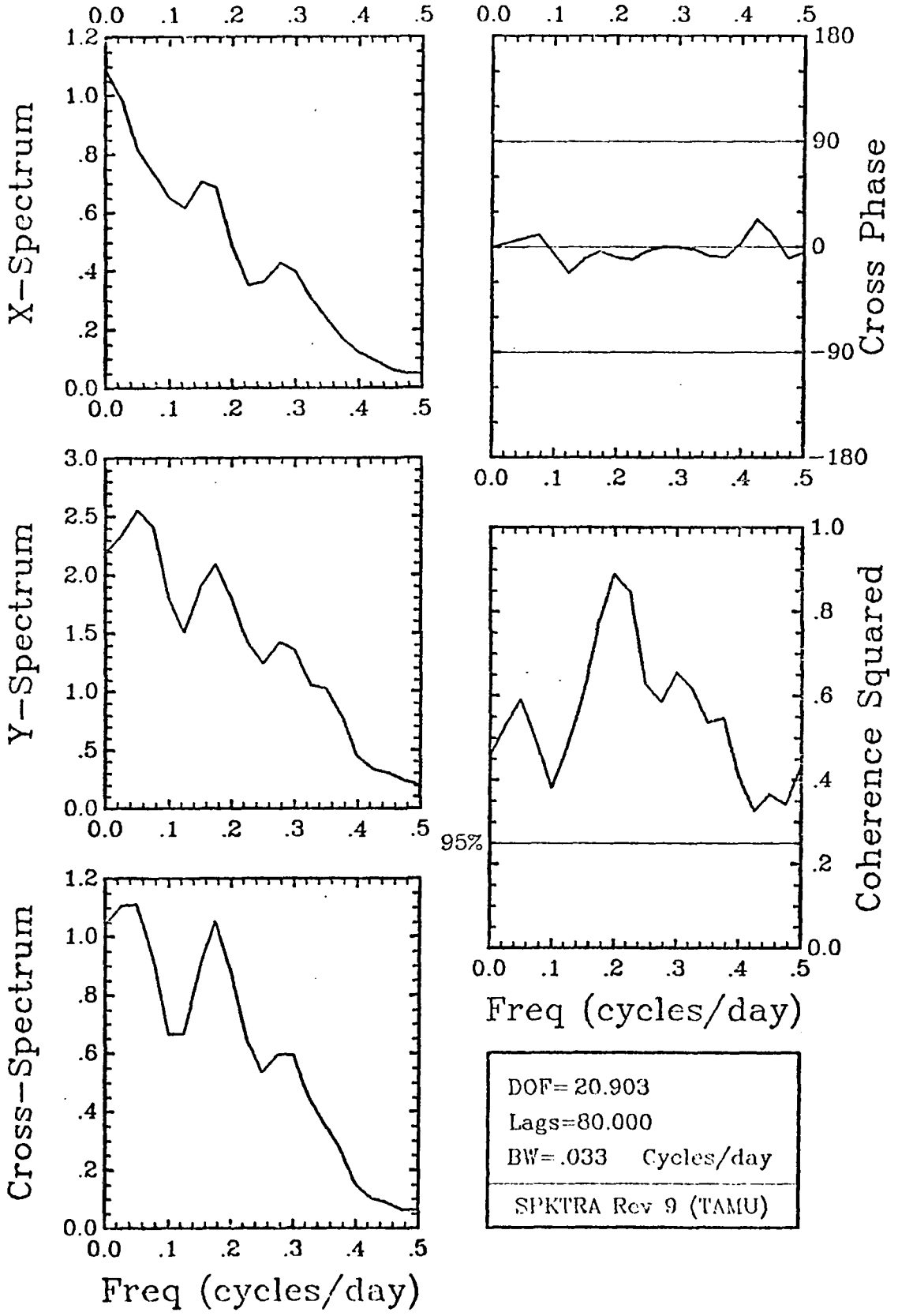
A_BU / B_BU winter 40 HR LP



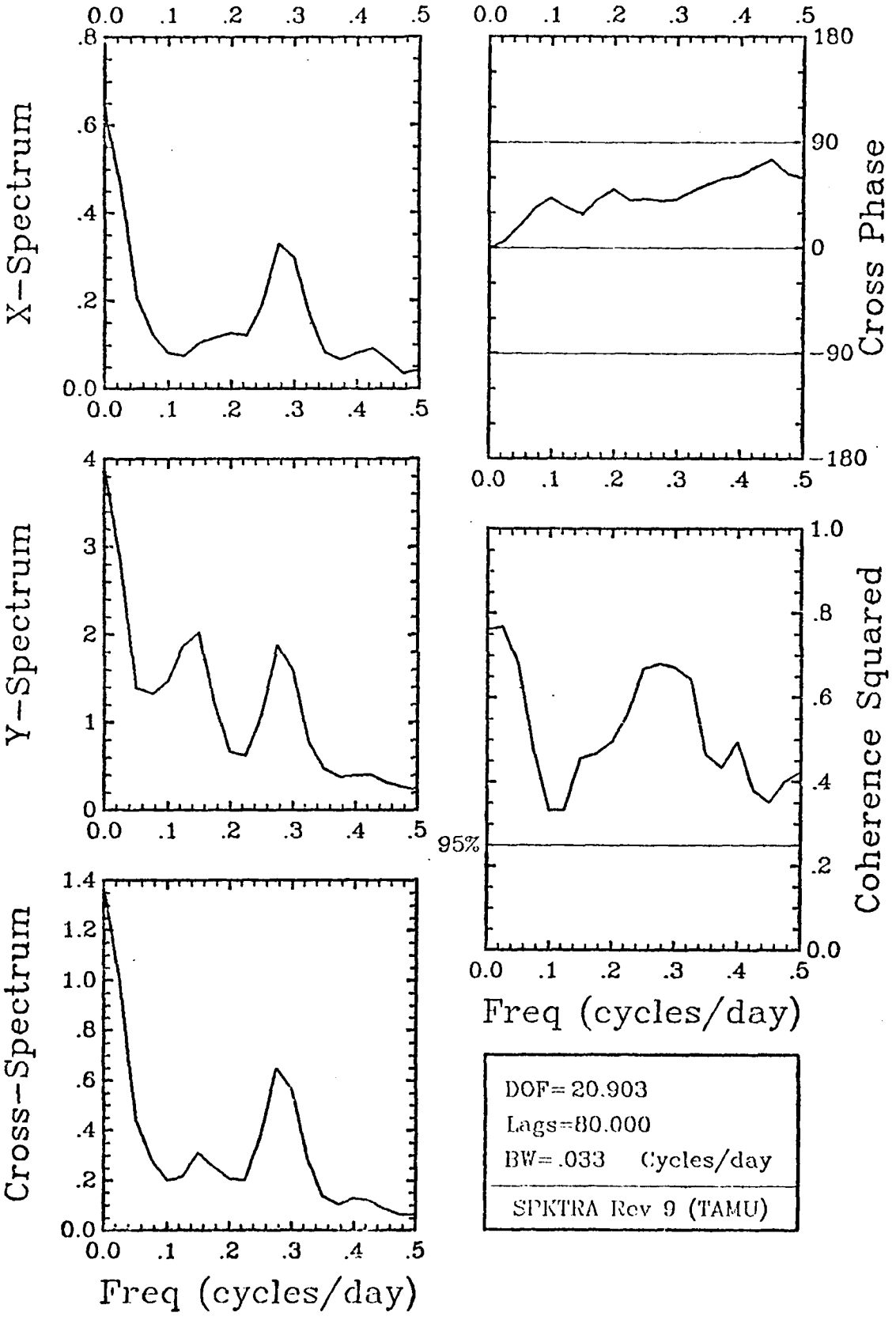
C_MV / D_MV winter 40 HR LP



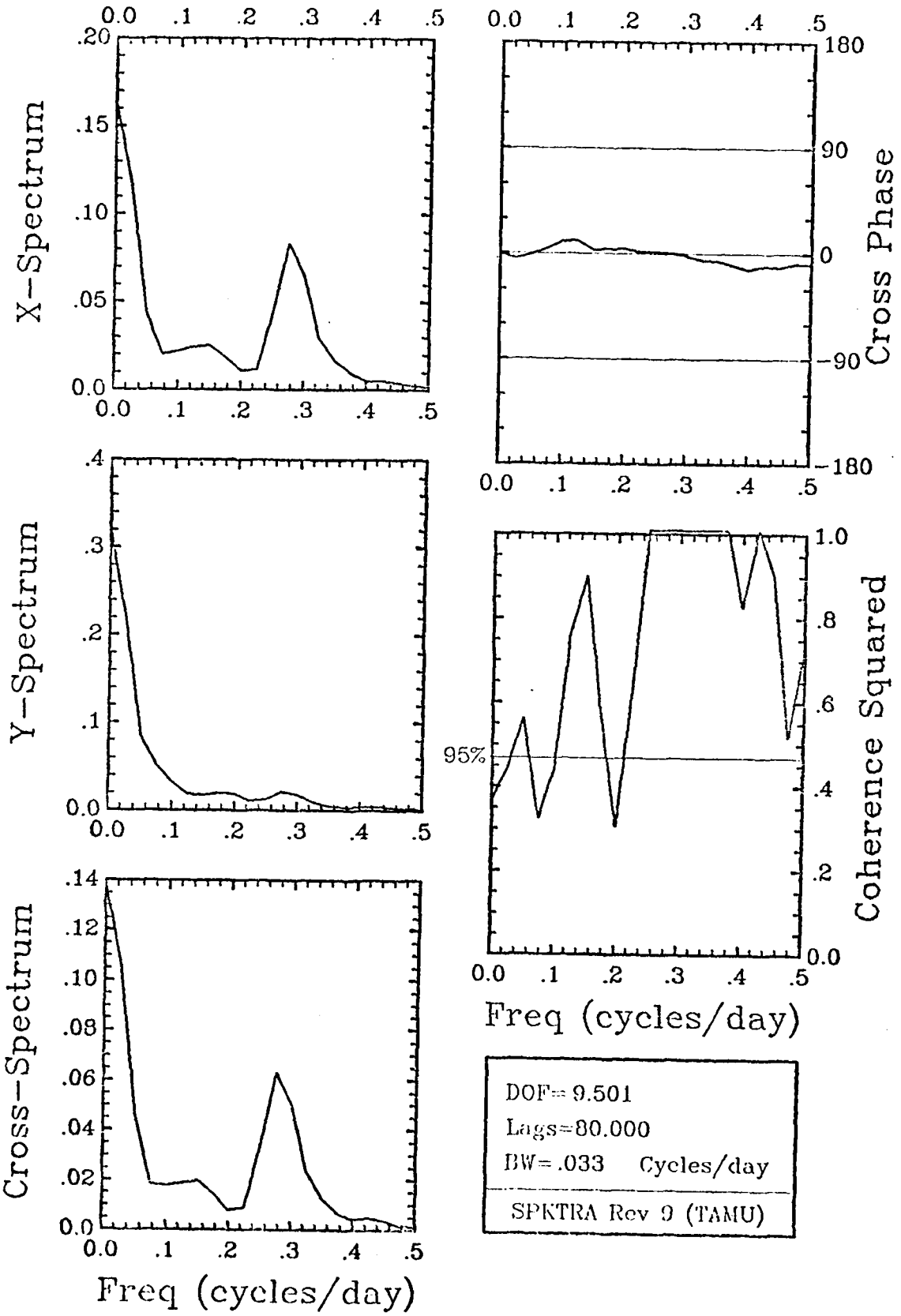
C_MU / D_MU winter 40 HR LP



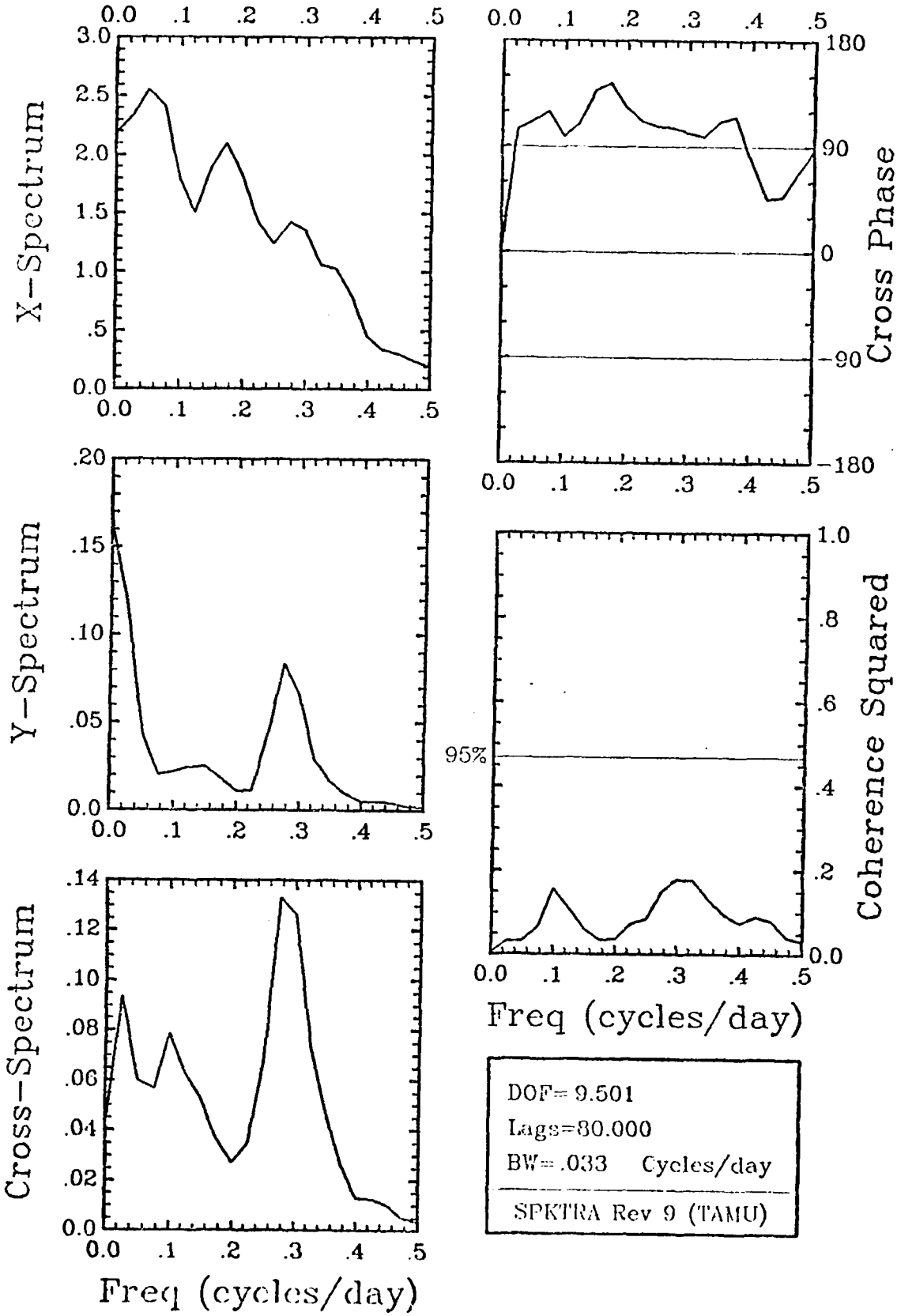
V-Stress$_{\text{HAT}}$ / V-Stress$_{\text{NDBO}}$ Winter 40 HR LP



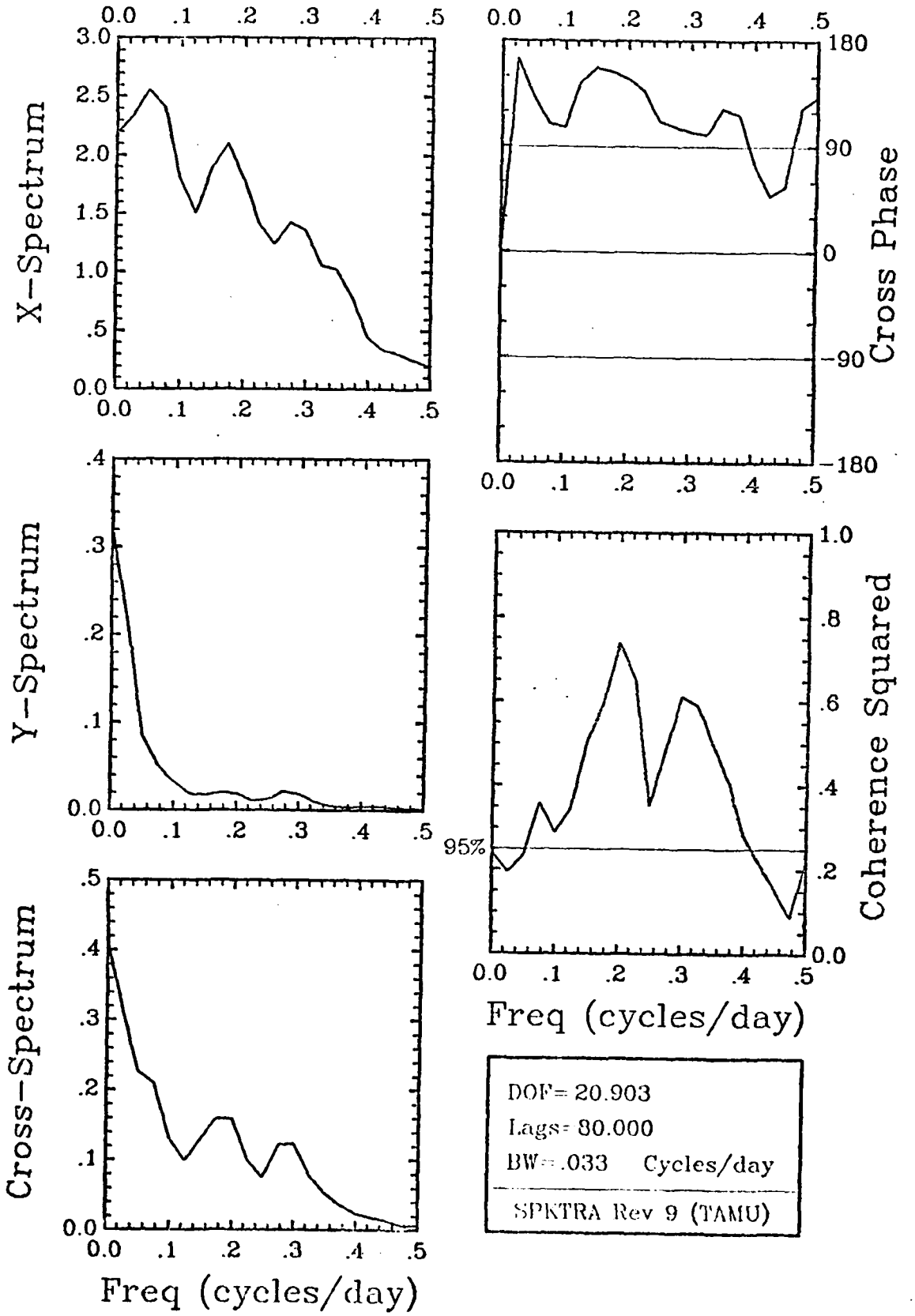
U–Stress$_{HAT}$ / U–Stress$_{NDBO}$ Winter 40 HR LP



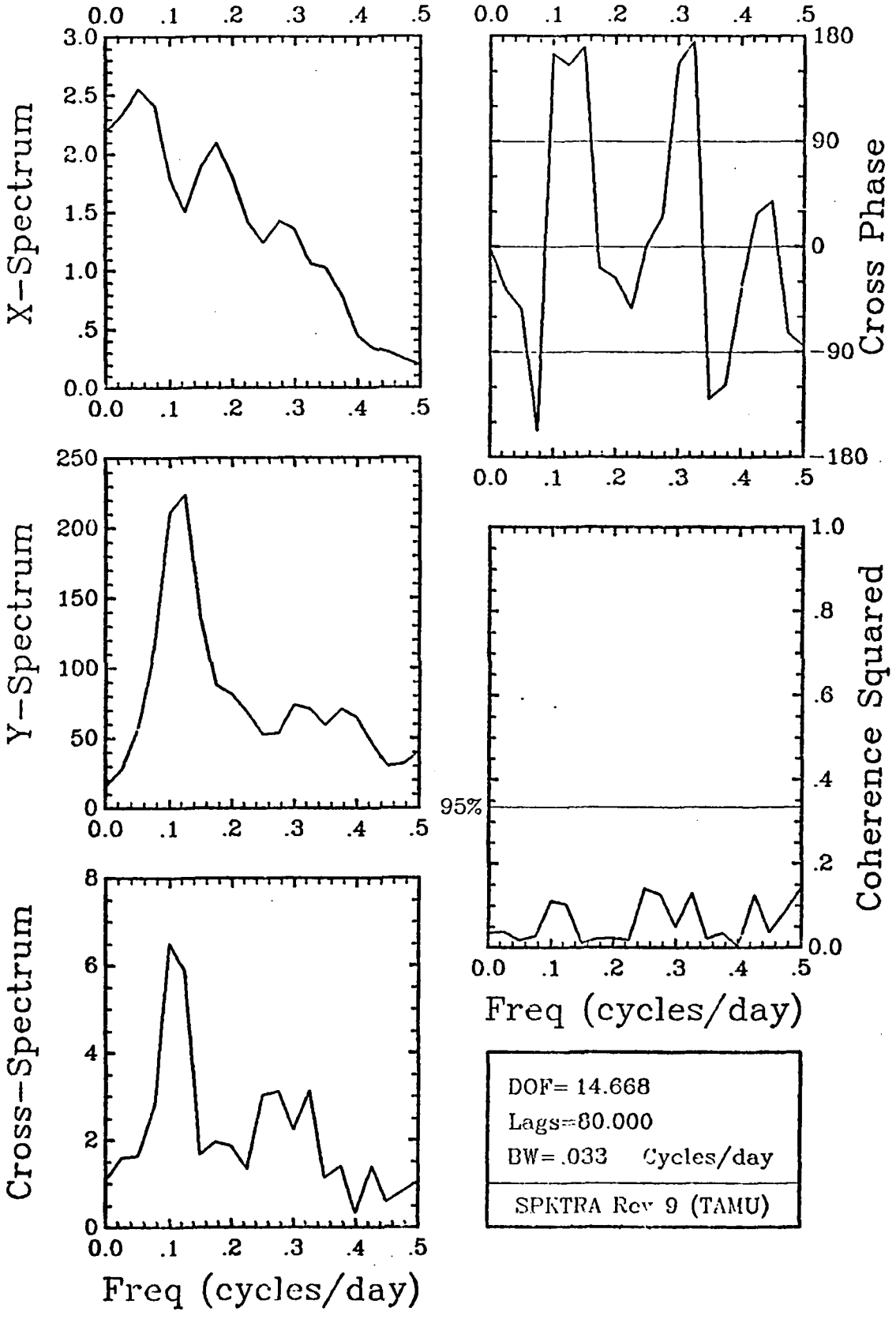
ADJ SL_{SPT} / ADJ SL_{BFT} Winter 40 HR LP



V-Stress$_{NDBO}$ / ADJ SL$_{SPT}$ Winter 40 HR LP

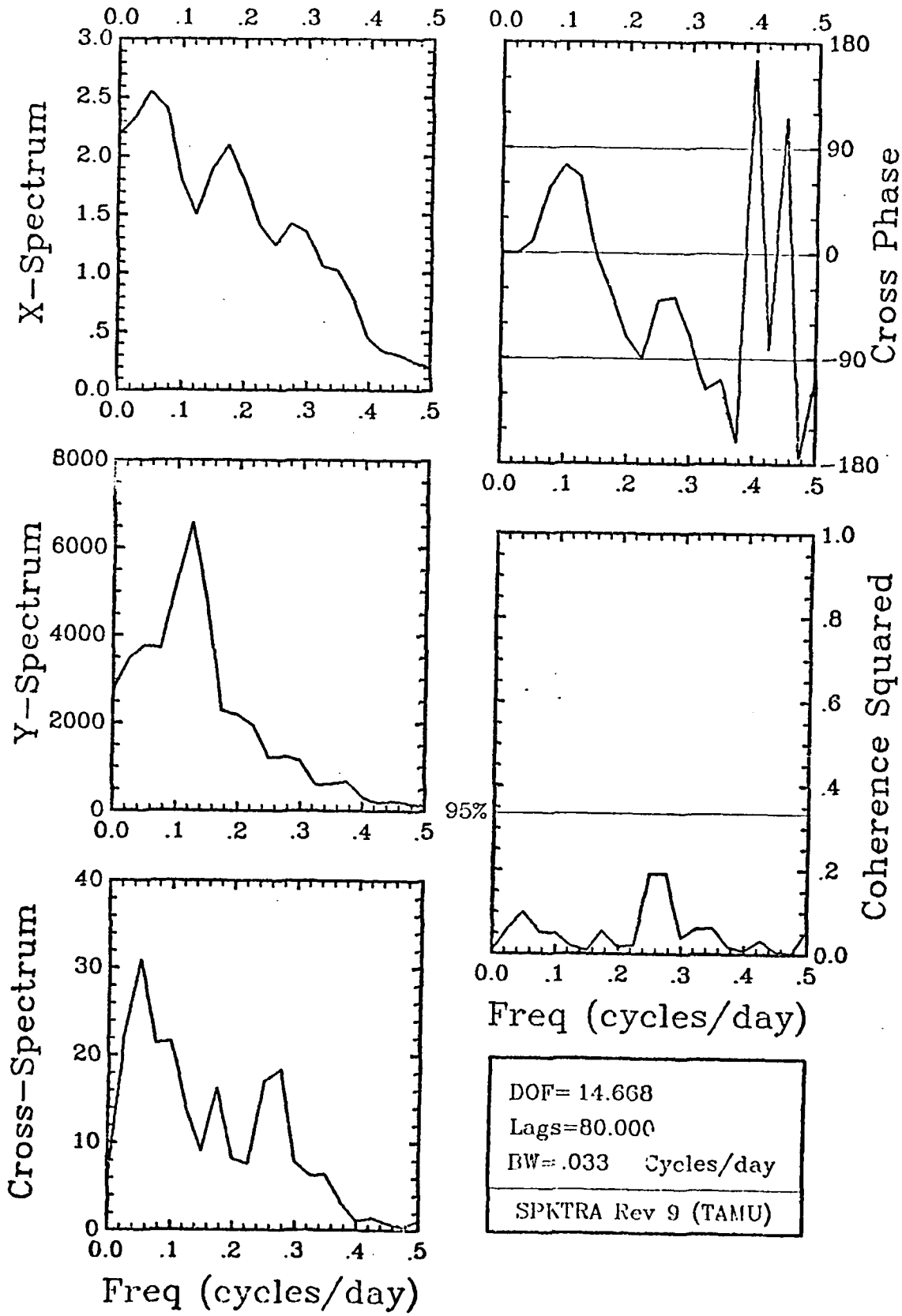


V-Stress$_{NDBO}$ / ADJ SL$_{BFT}$ Winter 40 HR LP

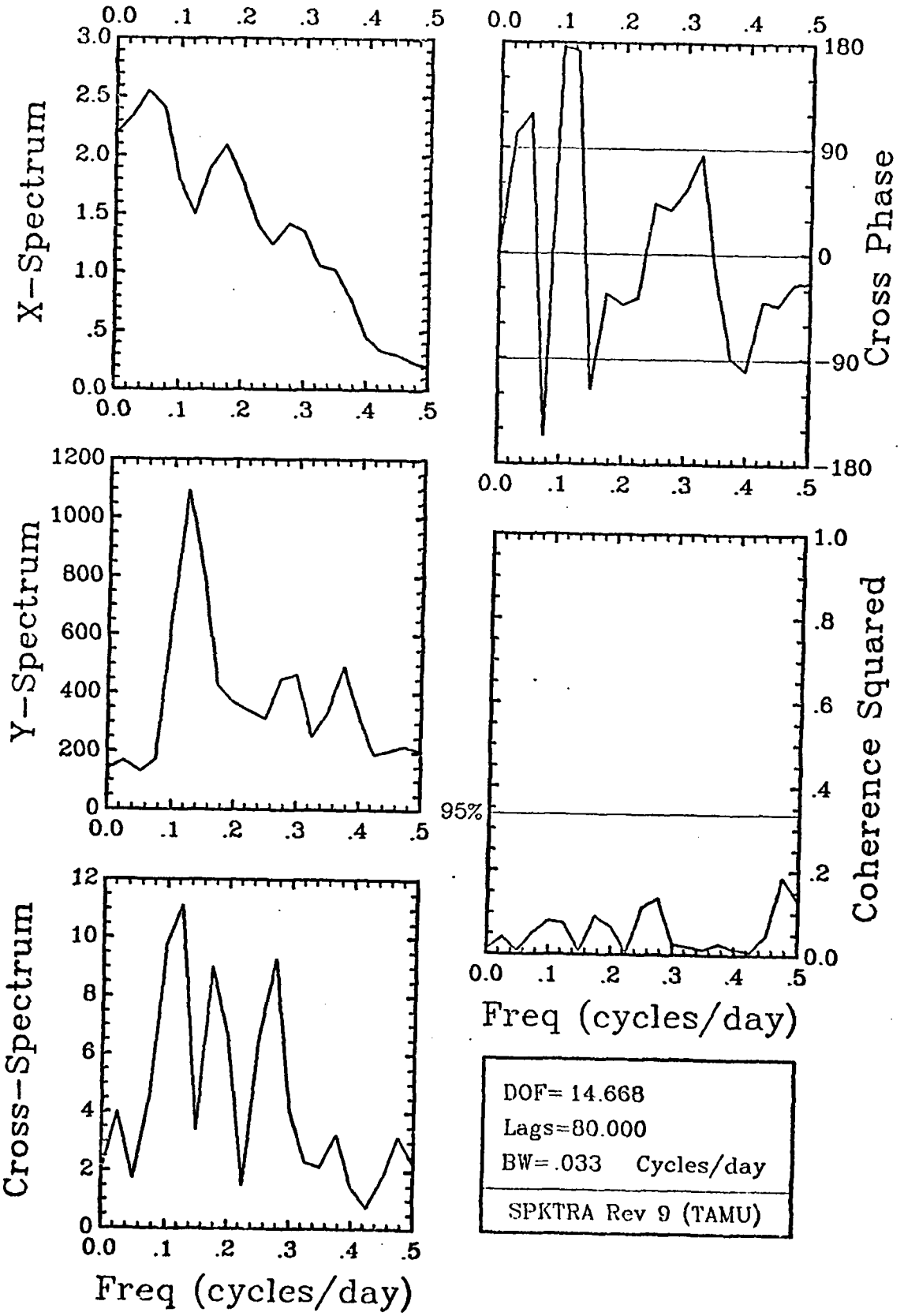


V-Stress$_{NDDO}$ / A_TU

Winter 40 HR LP

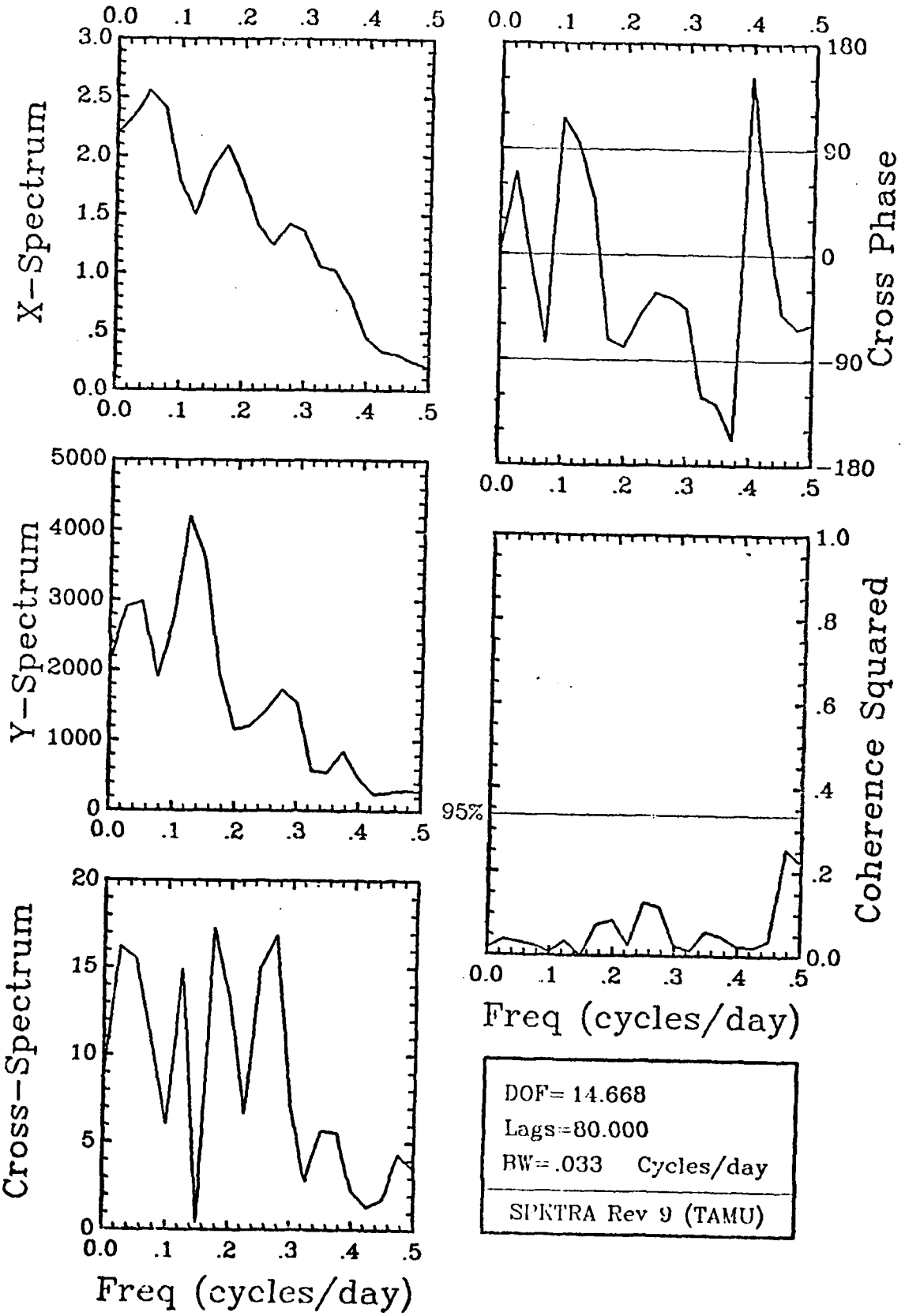


$V-Stress_{NDBO}$ / $A_T V$ Winter 40 HR LP



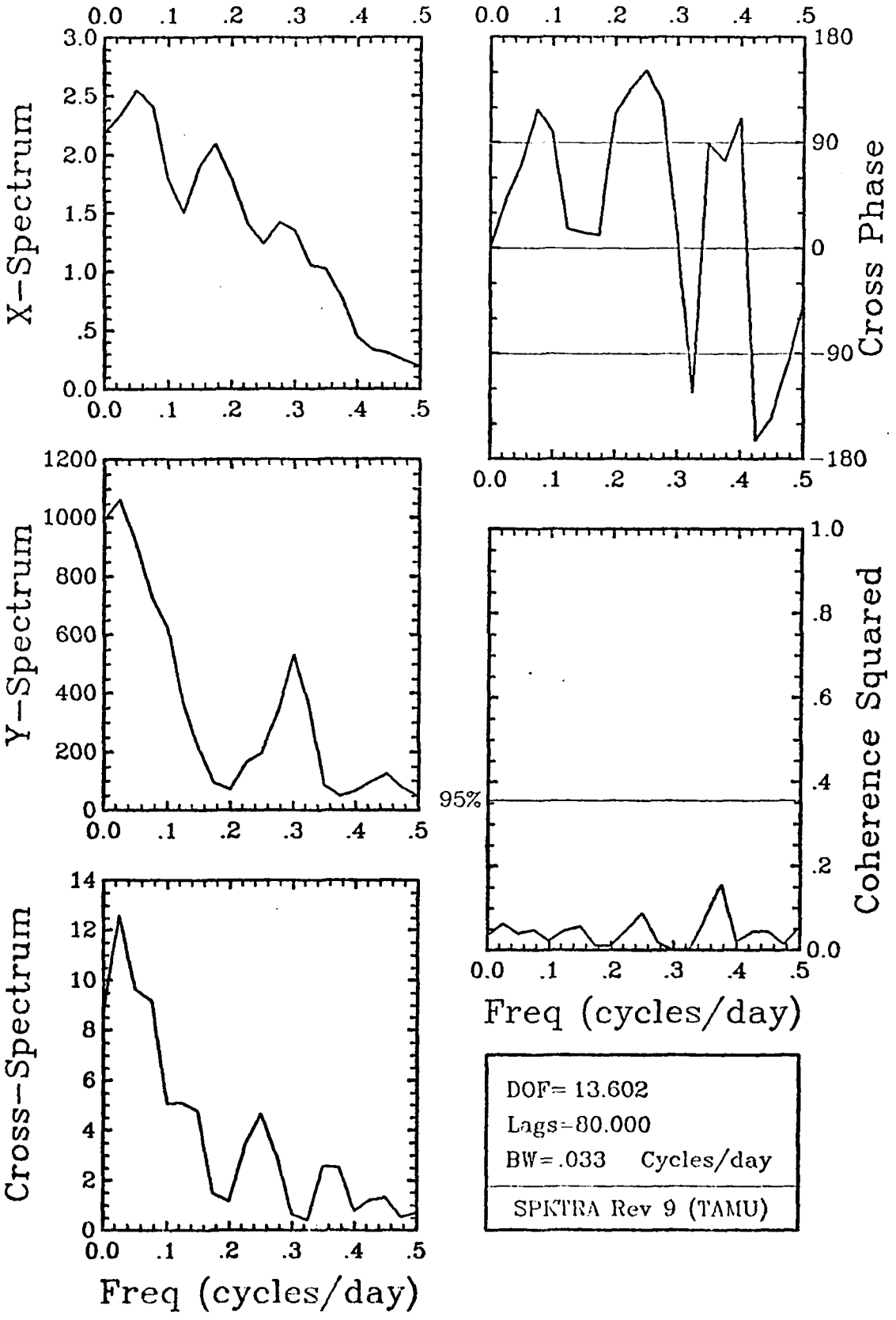
$V\text{-}Stress_{NDBO}$ / $B_T U$

Winter 40 HR LP

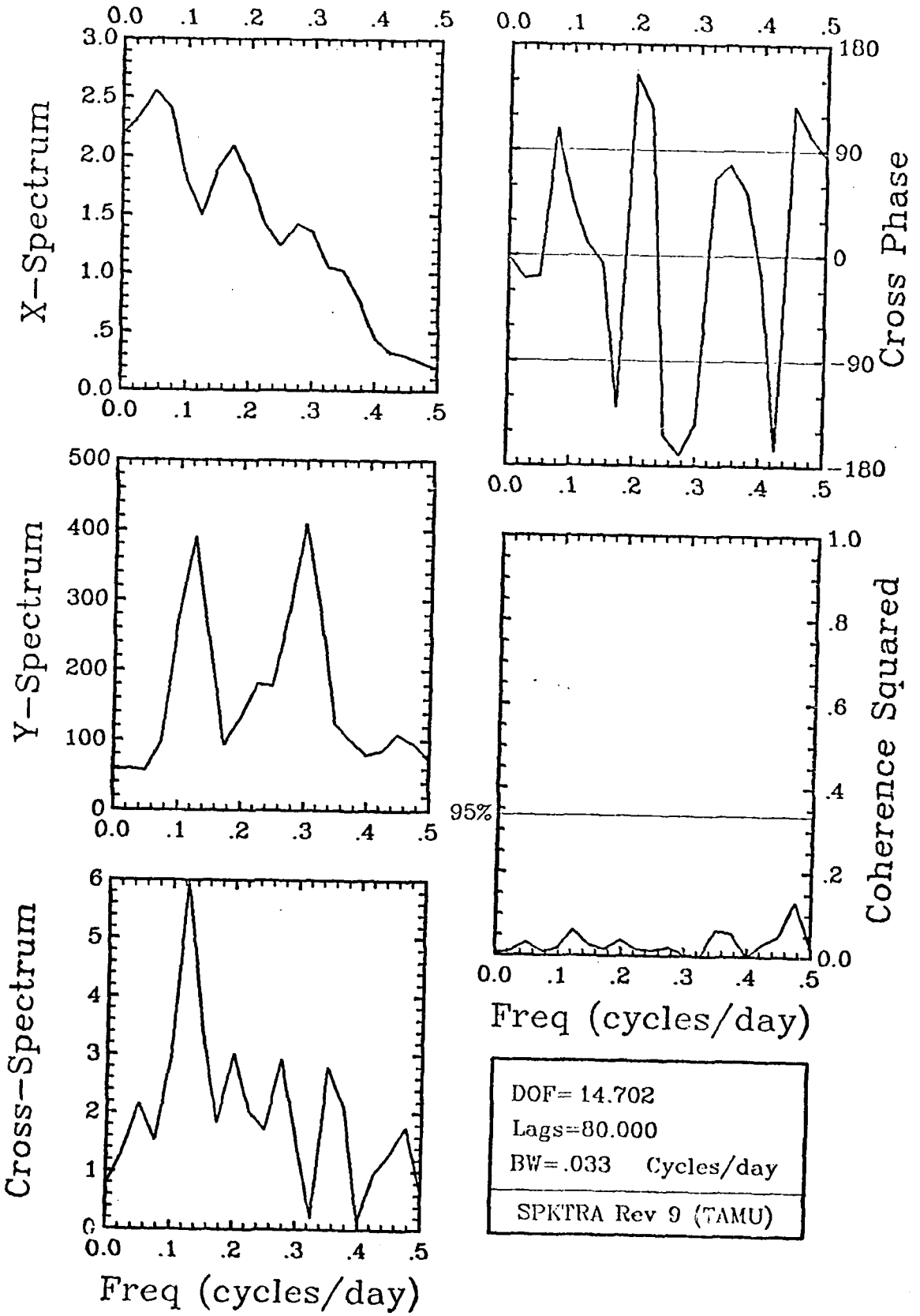


V-Stress$_{NDBO}$ / B_TV

Winter 40 HR LP

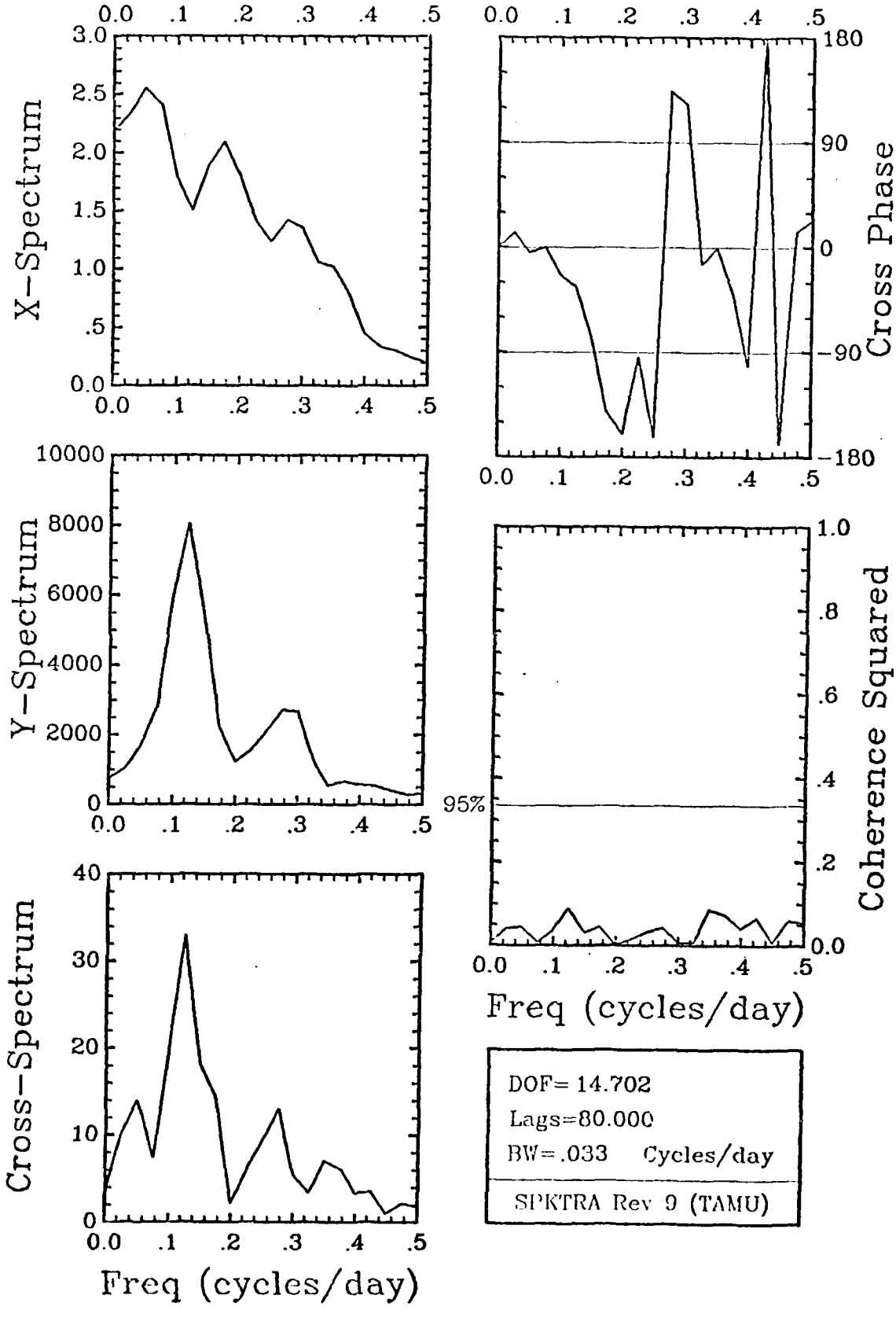


$V-Stress_{NDBO}$ / C_MU Winter 40 HR LP

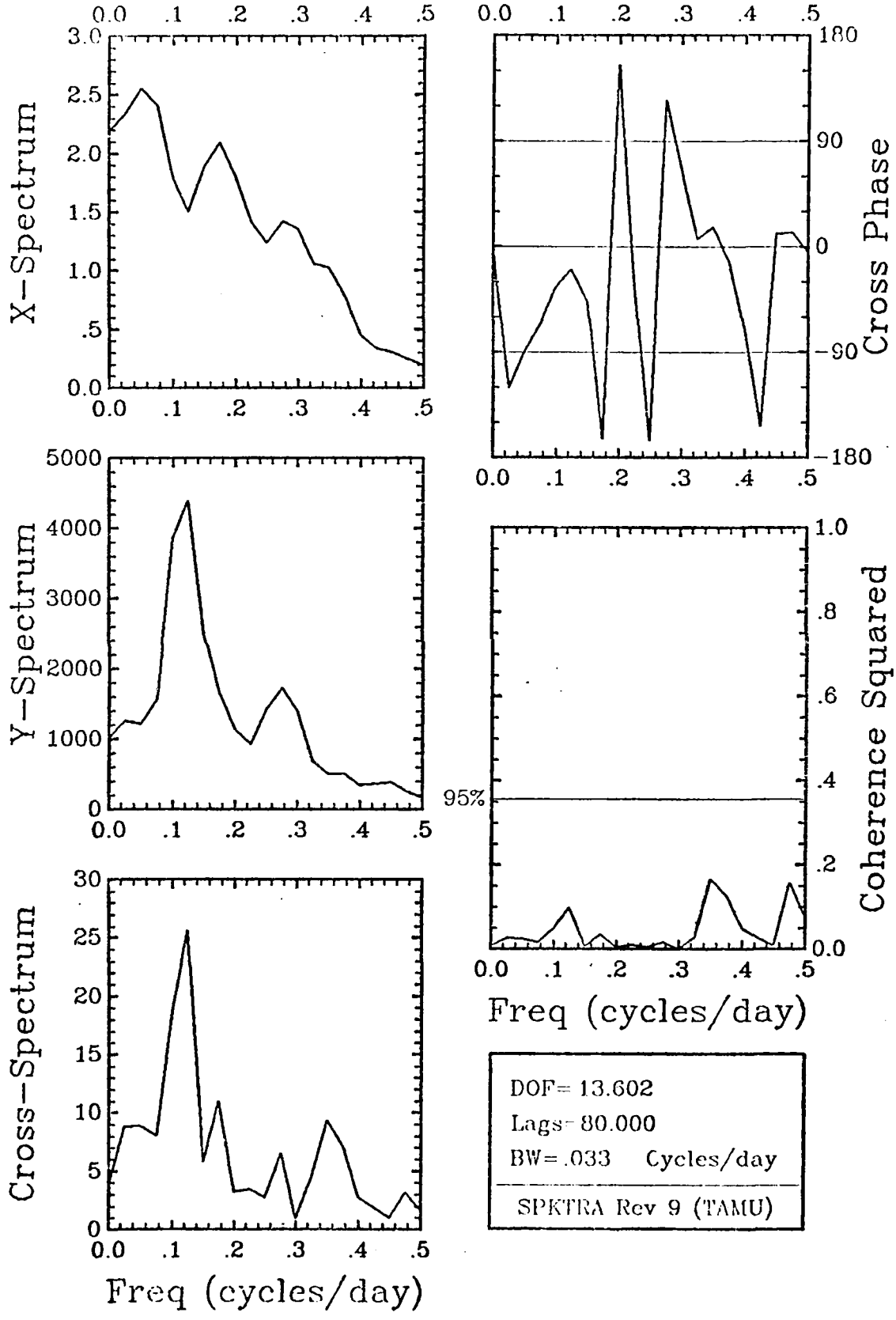


V-Stress$_{NDBO}$ / C_TU

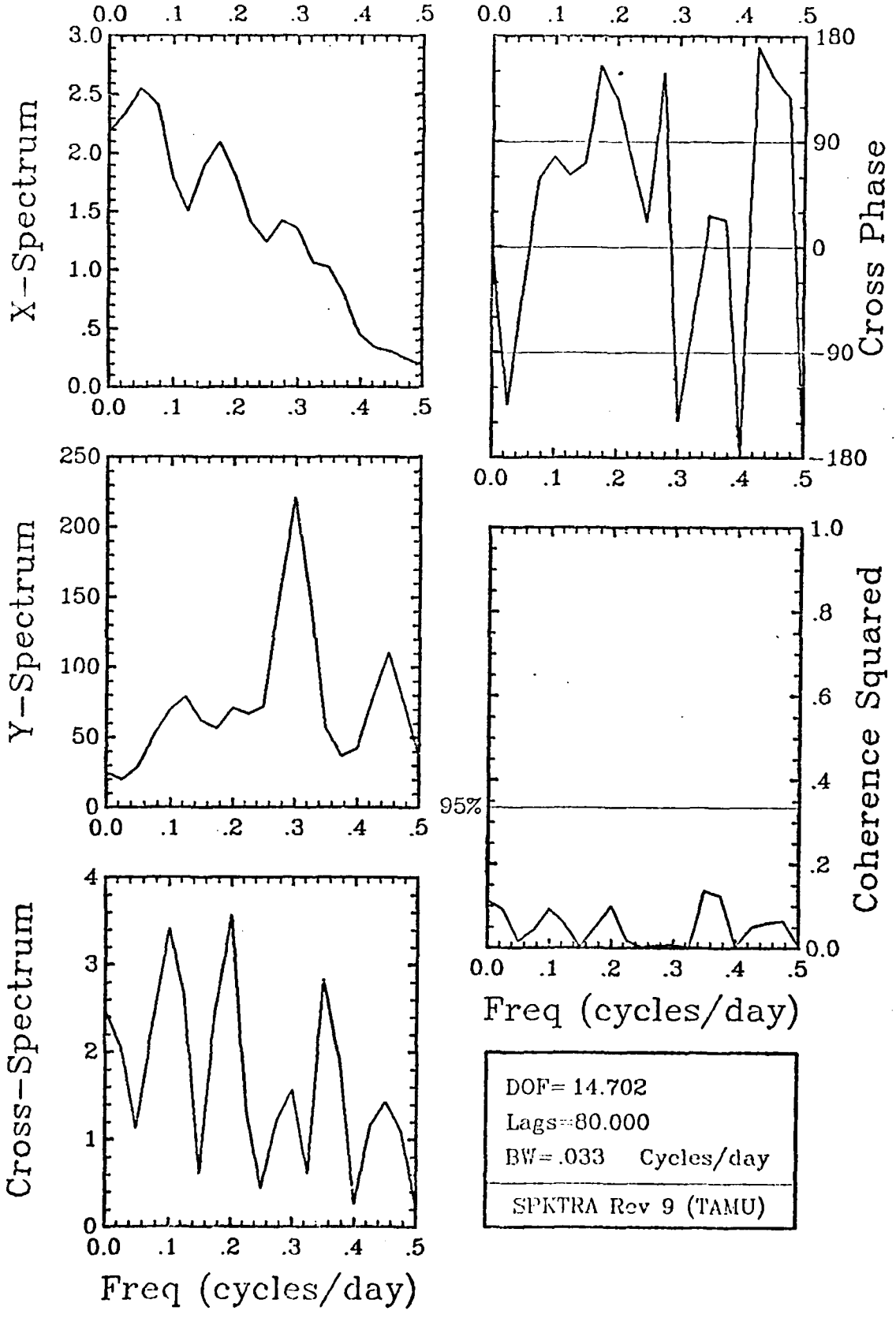
Winter 40 HR LP



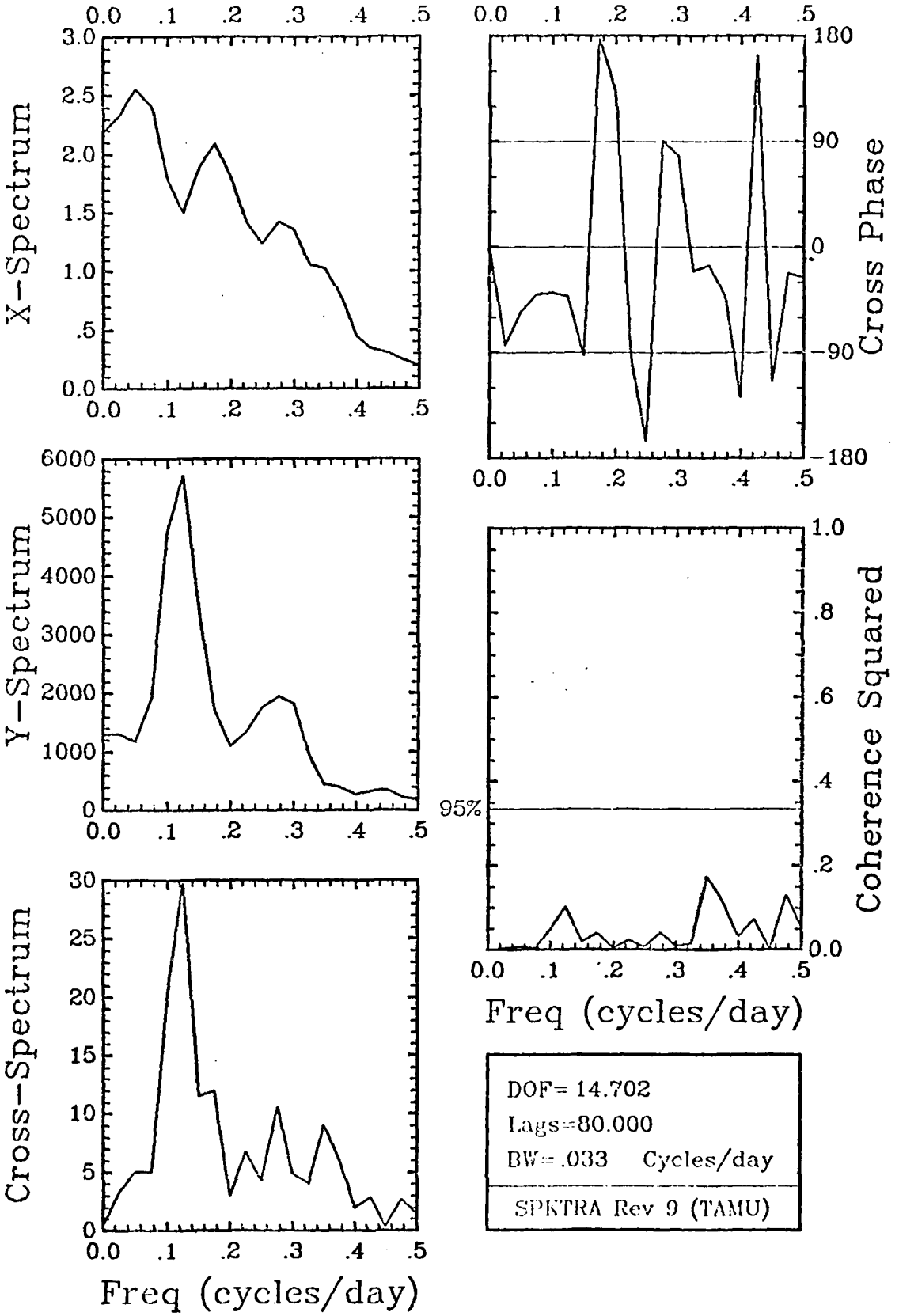
$V\text{-}Stress_{NDBO}$ / $C_T V$ Winter 40 HR LP



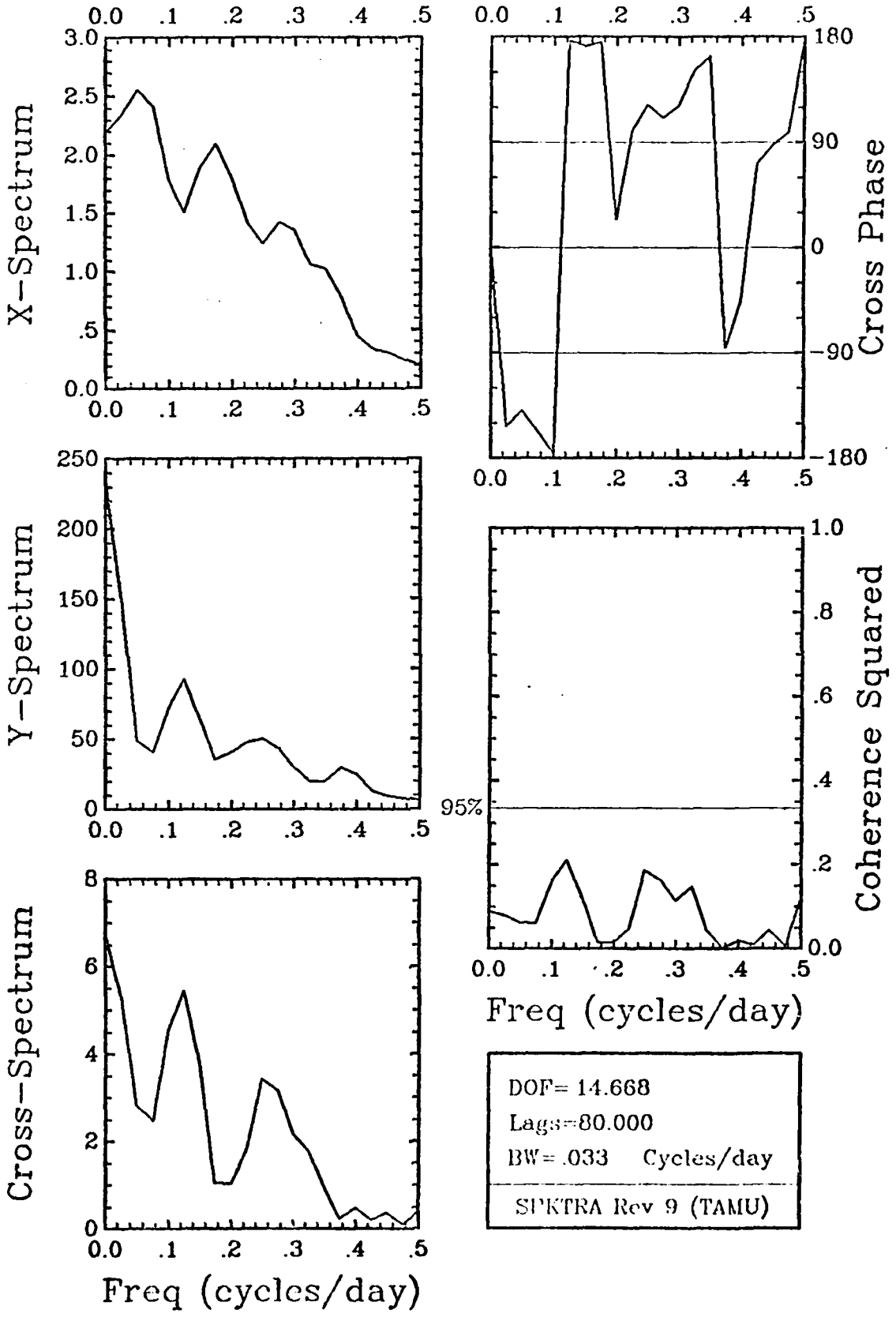
$V\text{-}Stress_{NDBO}$ / $C_M V$ Winter 40 HR LP



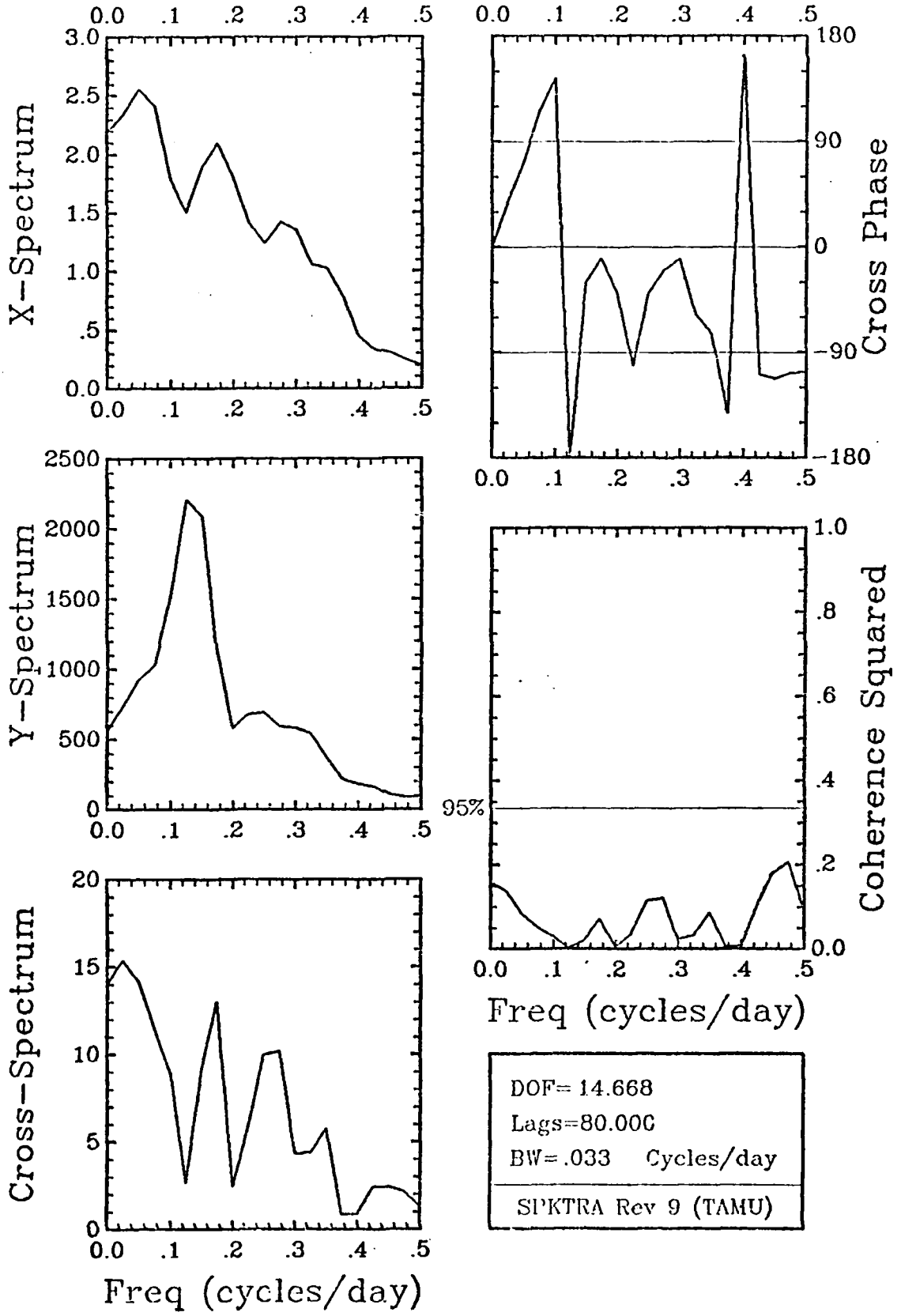
V-Stress$_{NDBO}$ / D_MU Winter 40 HR LP



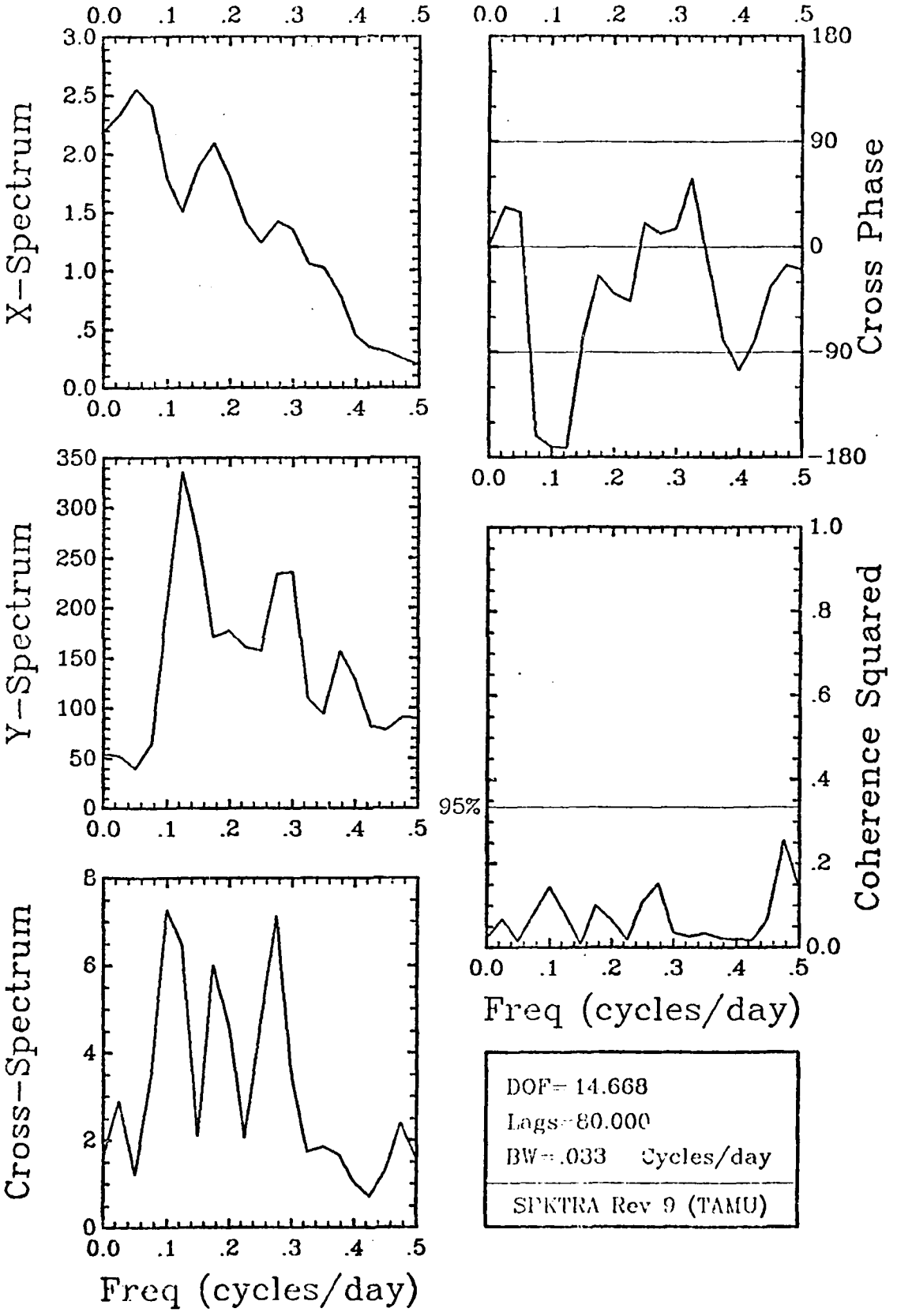
$V-Stress_{NDBO}$ / $D_M V$ Winter 40 HR LP



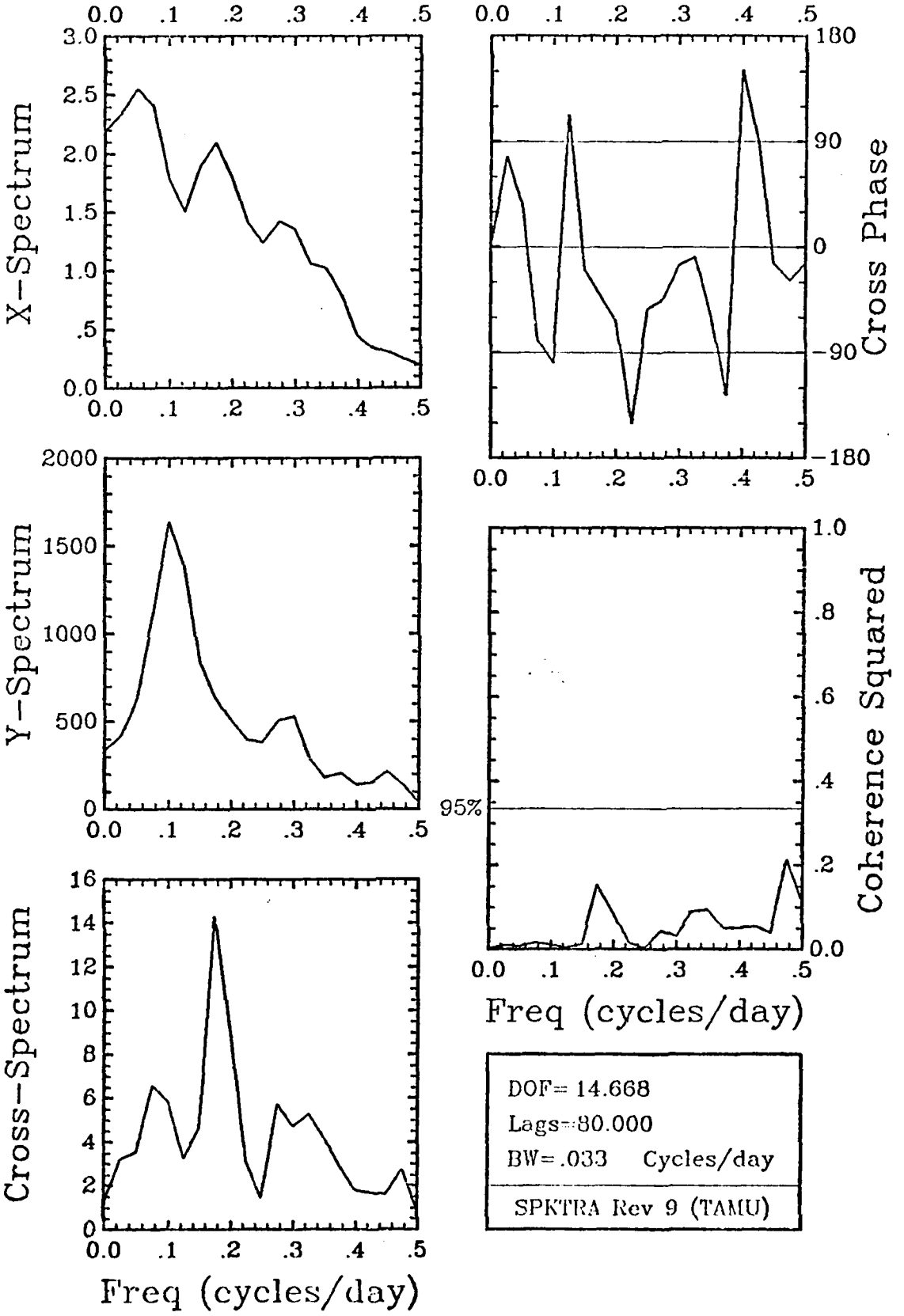
V-Stress$_{NDBO}$ / A_BU Winter 40 HR LP



V-Stress$_{NDBO}$ / A_BV Winter 40 HR '



$V-Stress_{NDBO}$ / B_BU Winter 40 HR LP



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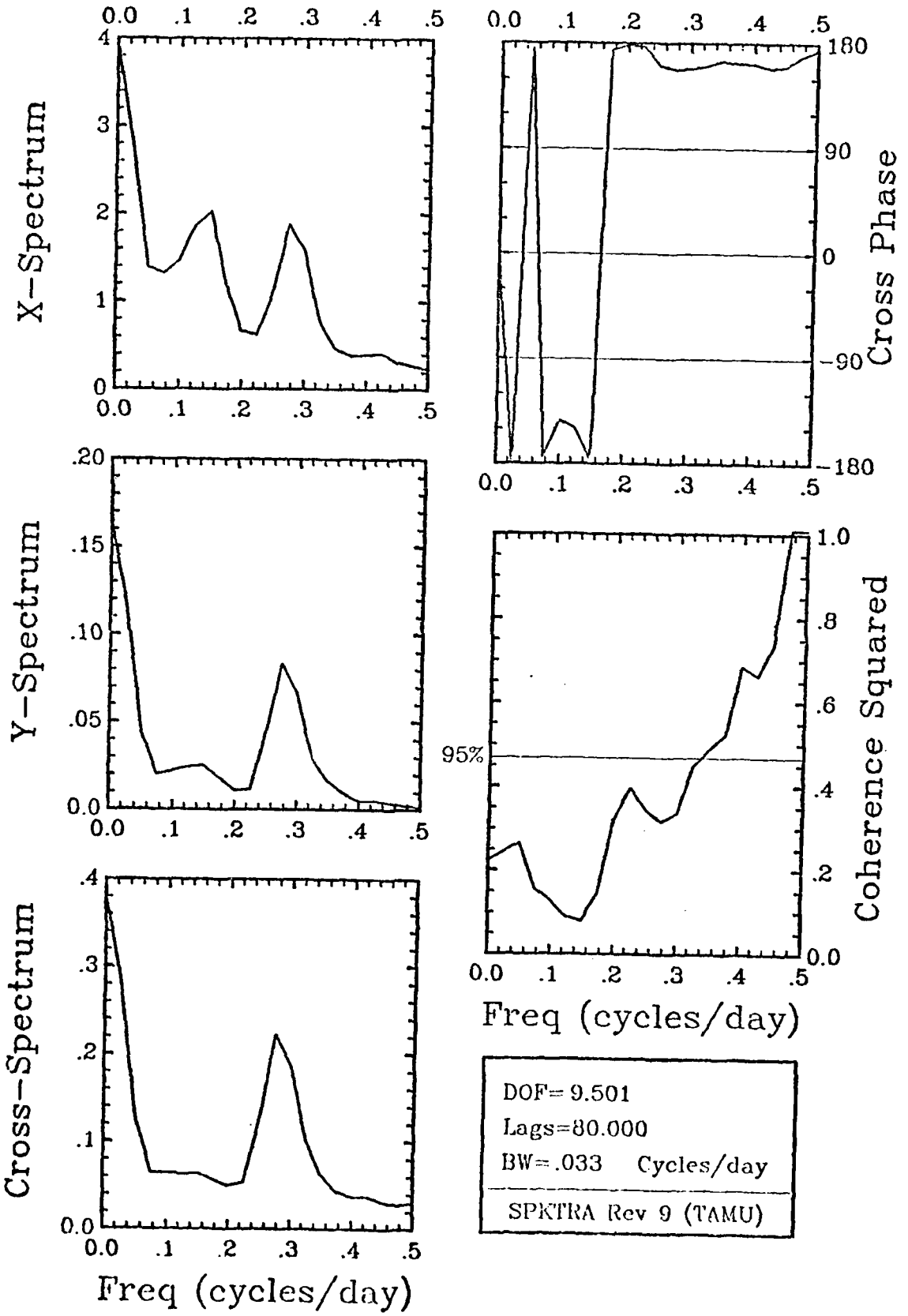

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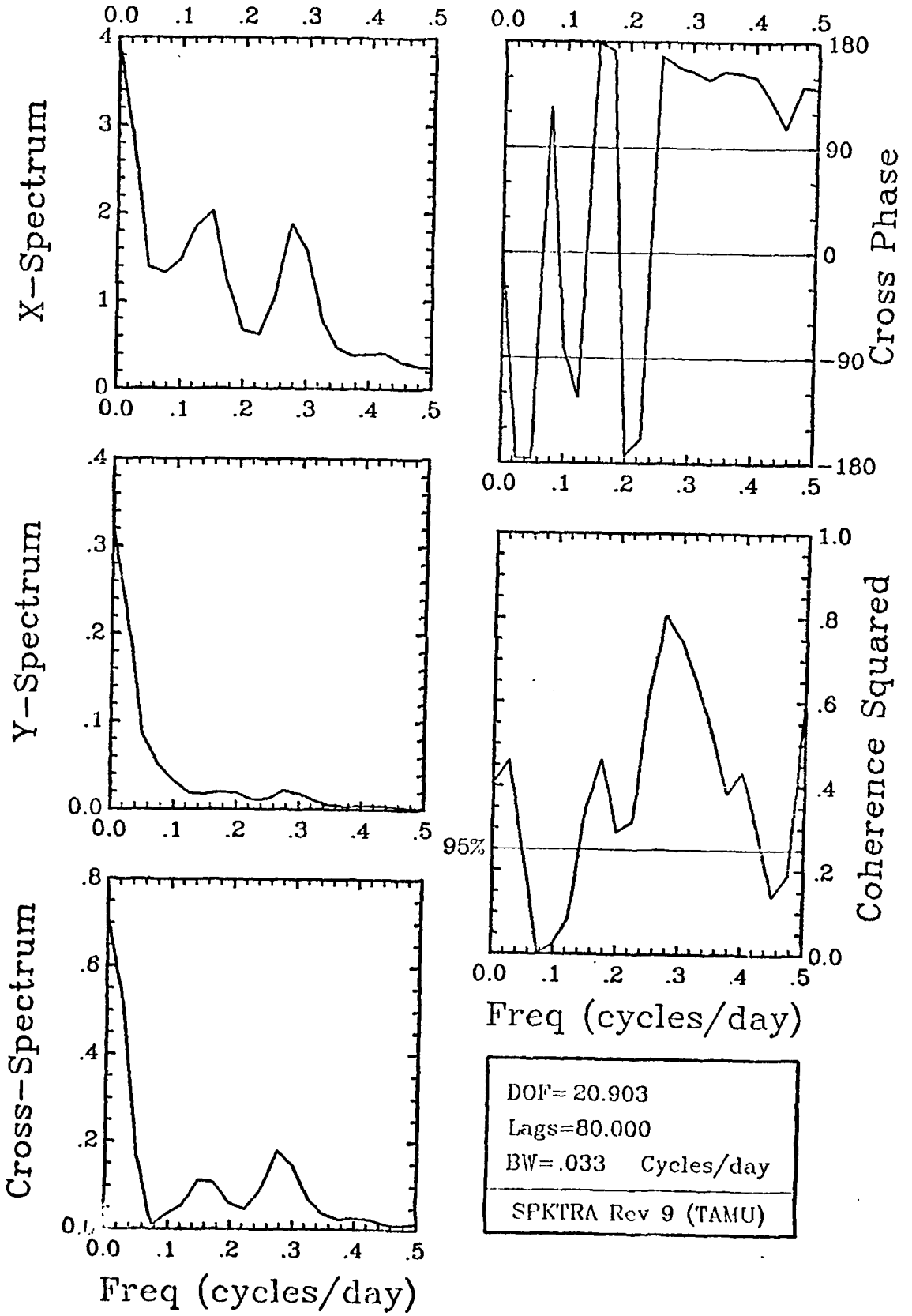

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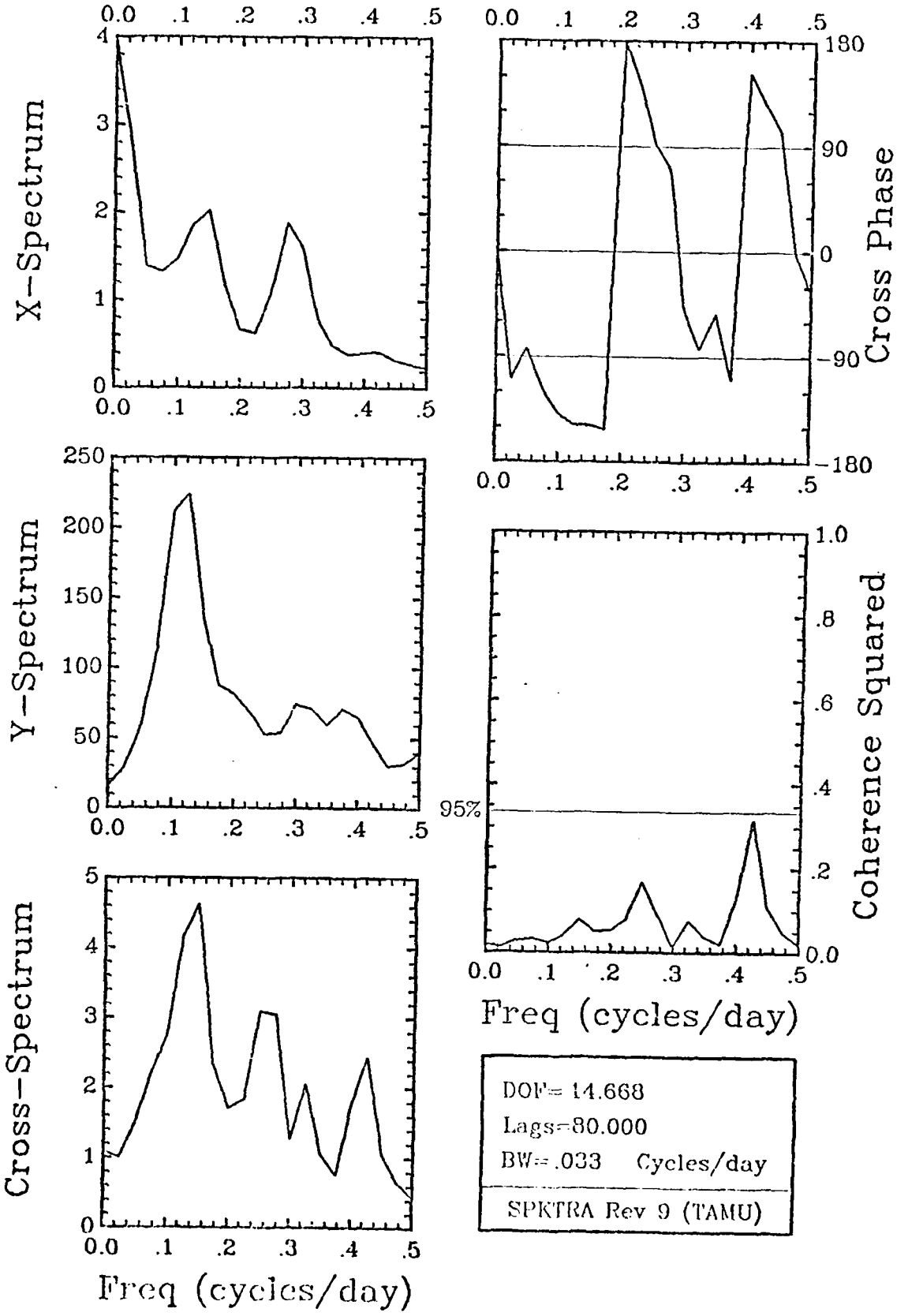

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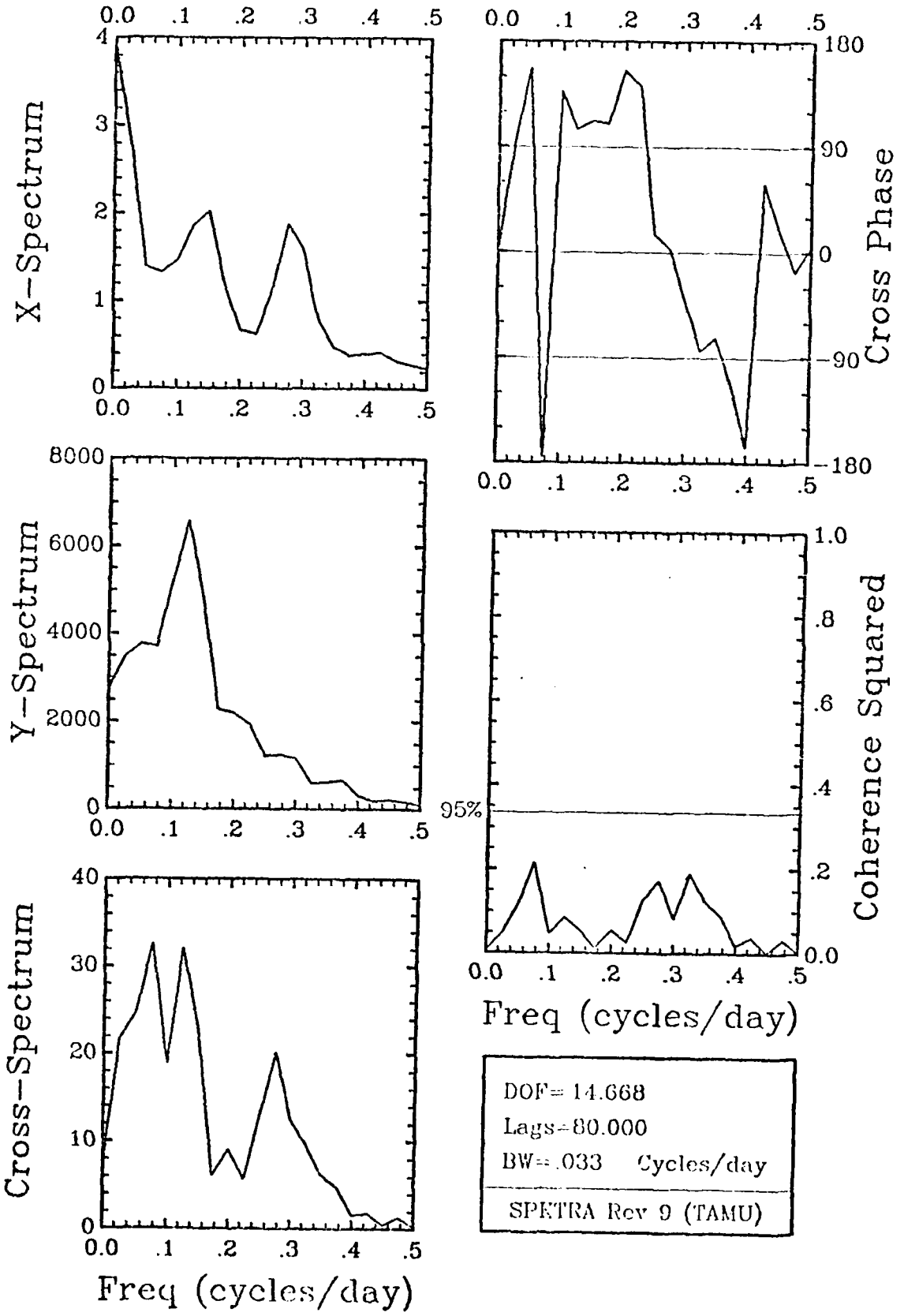
Winter 40 HR LP



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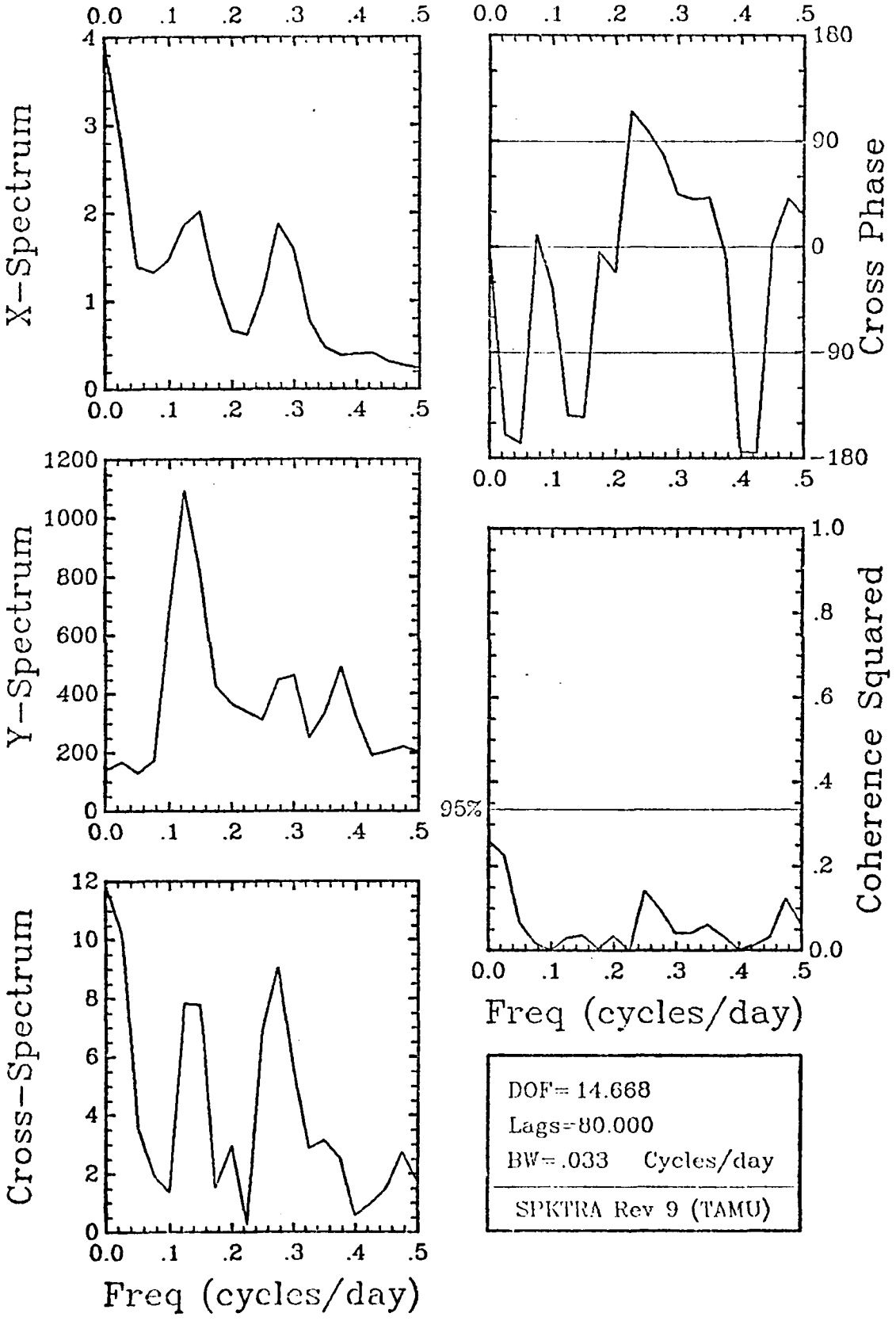

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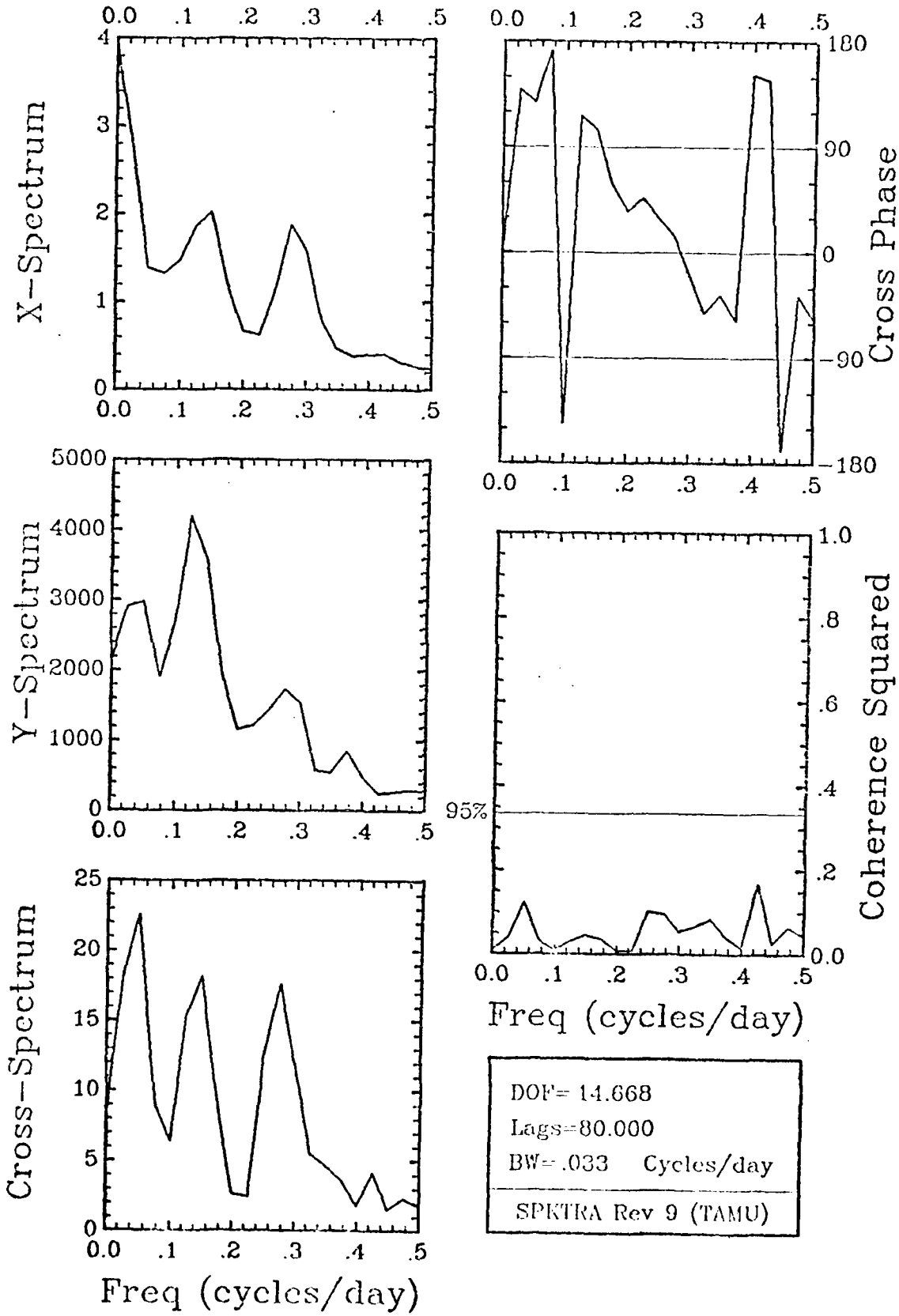

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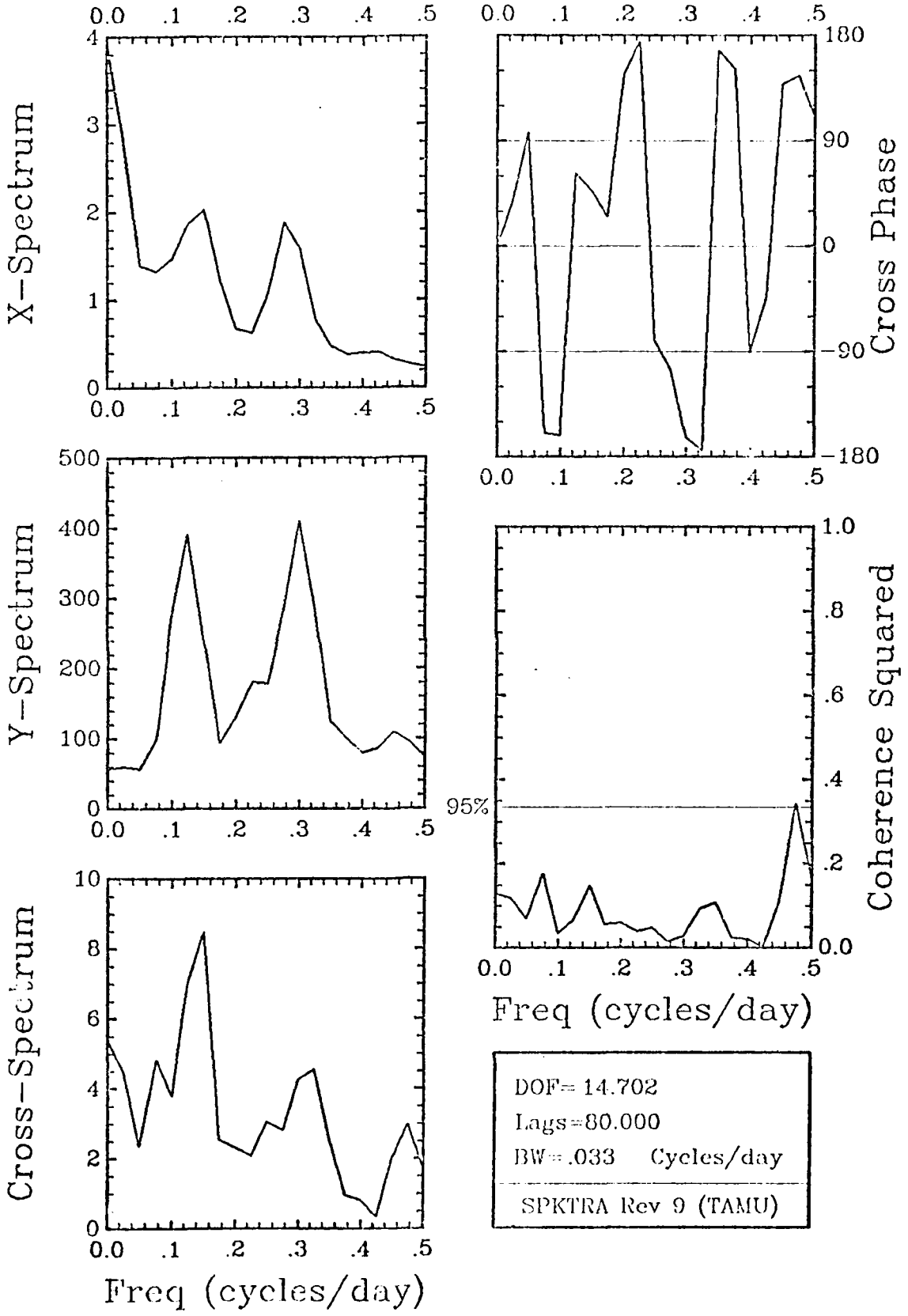

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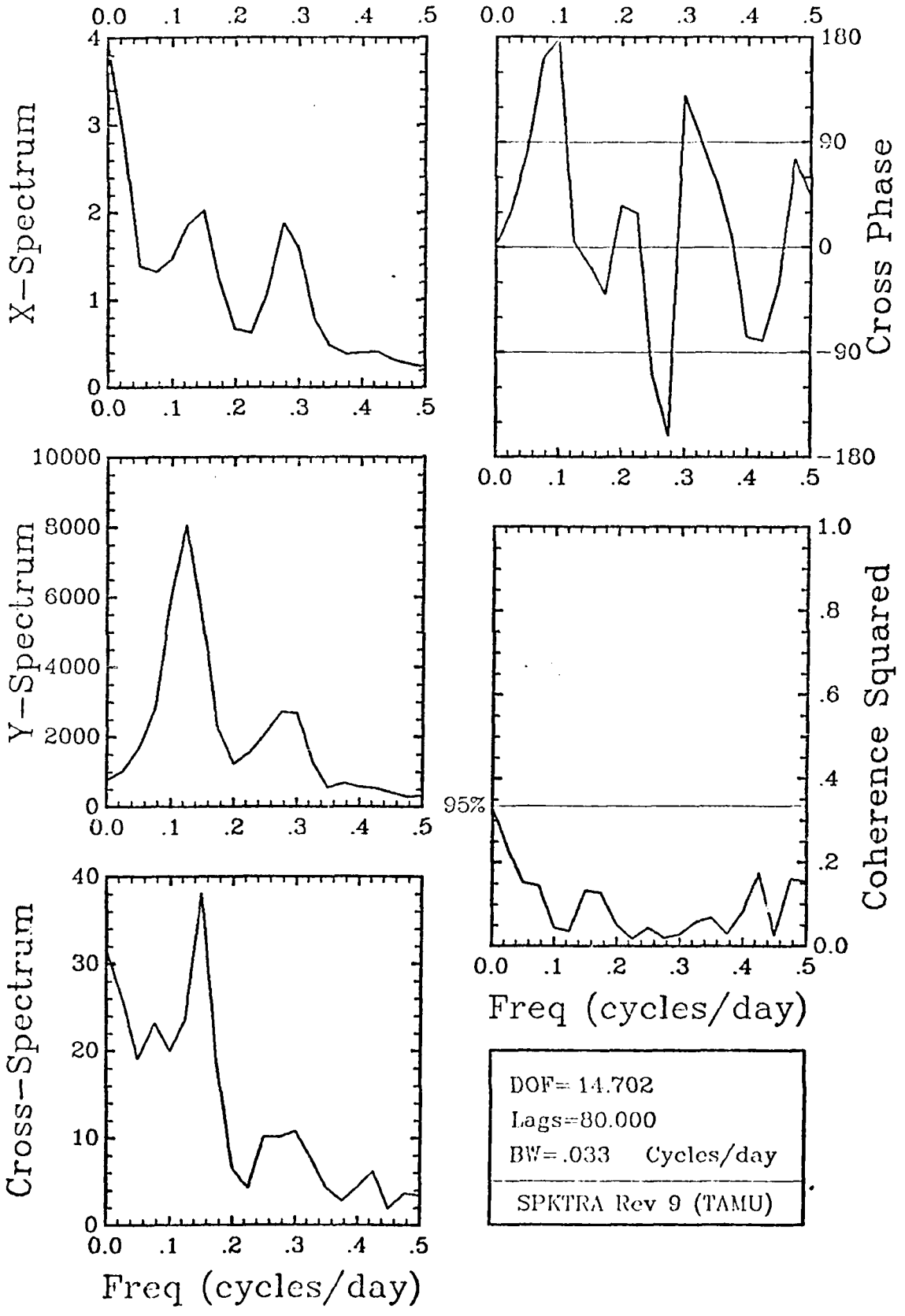

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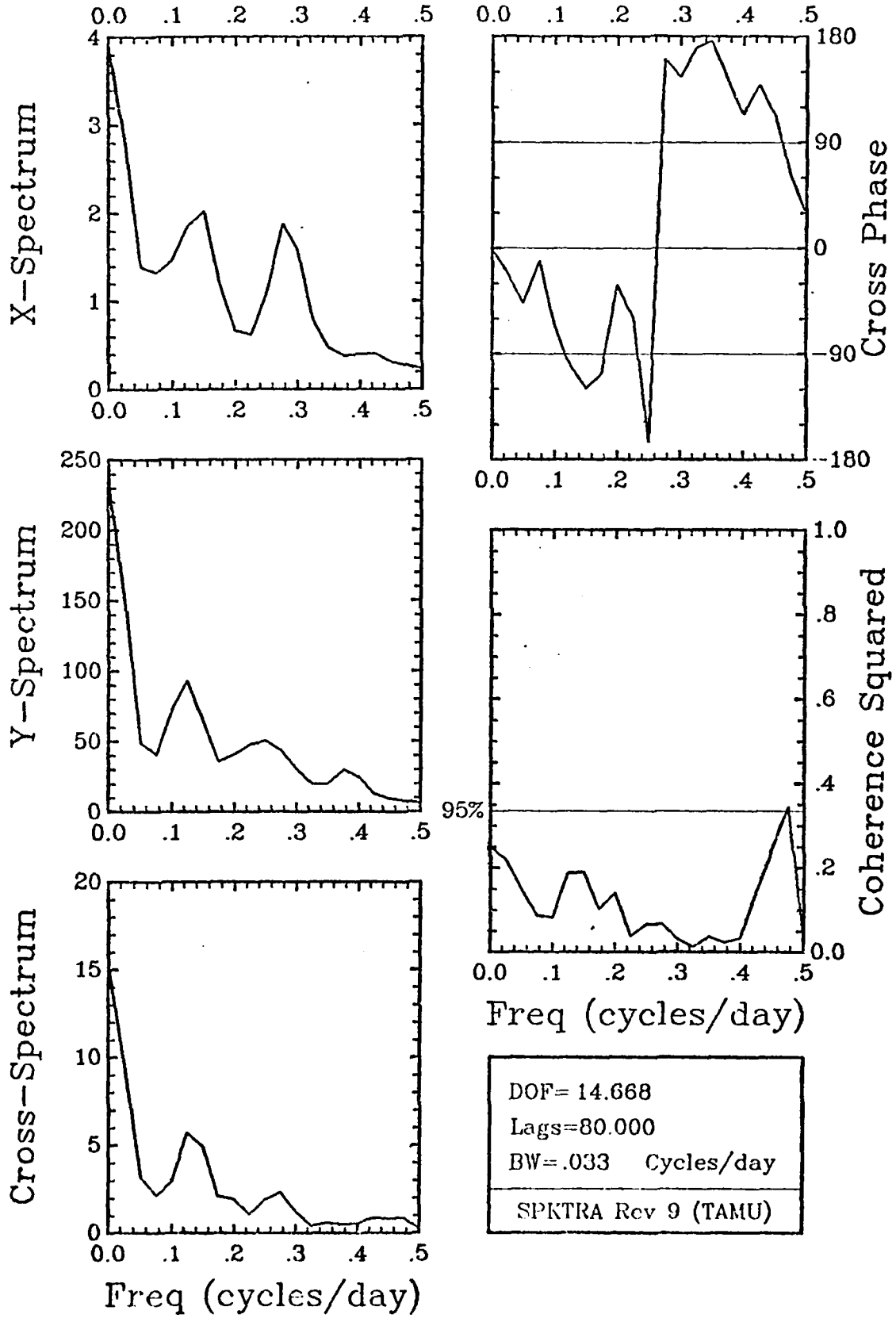

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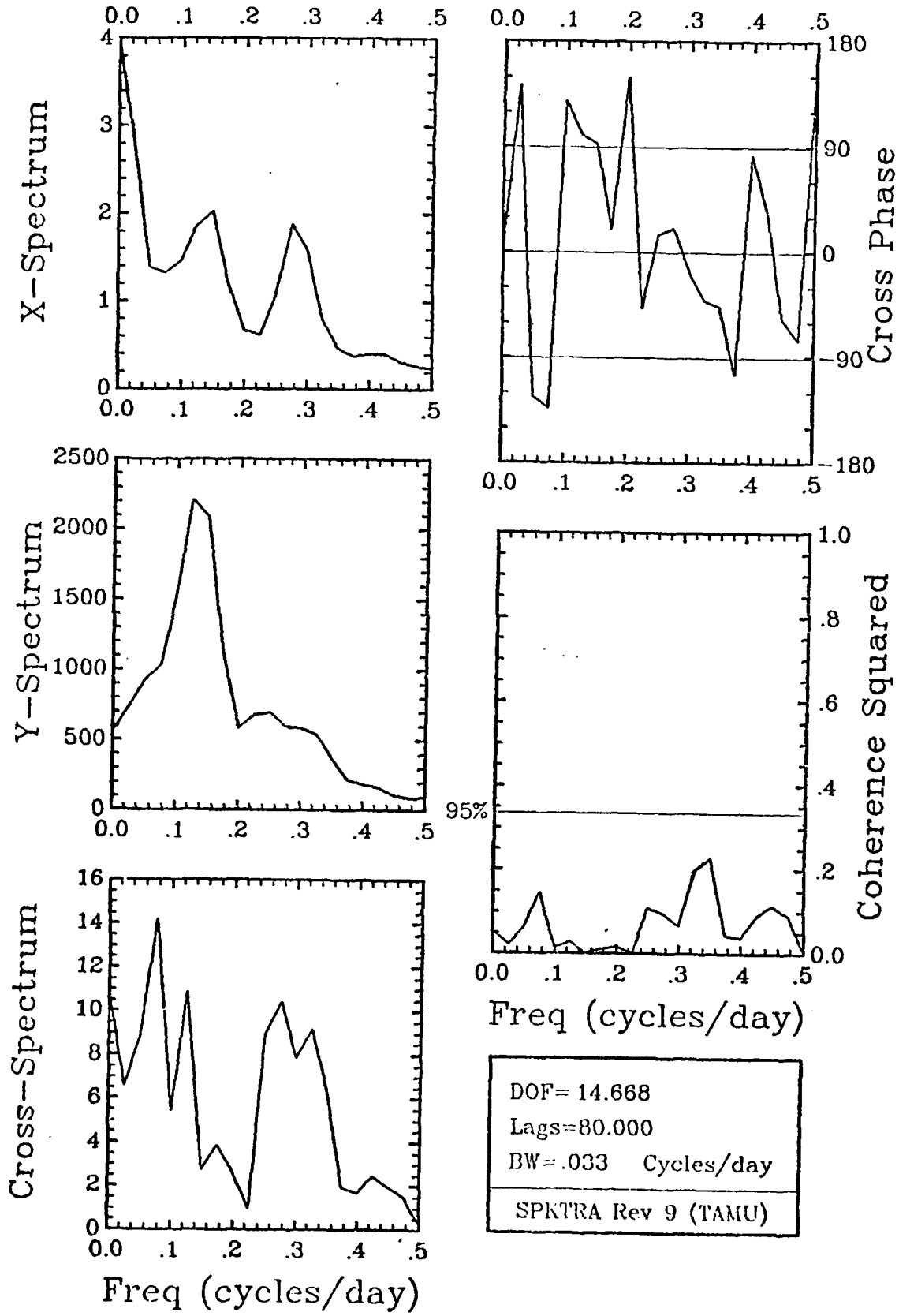

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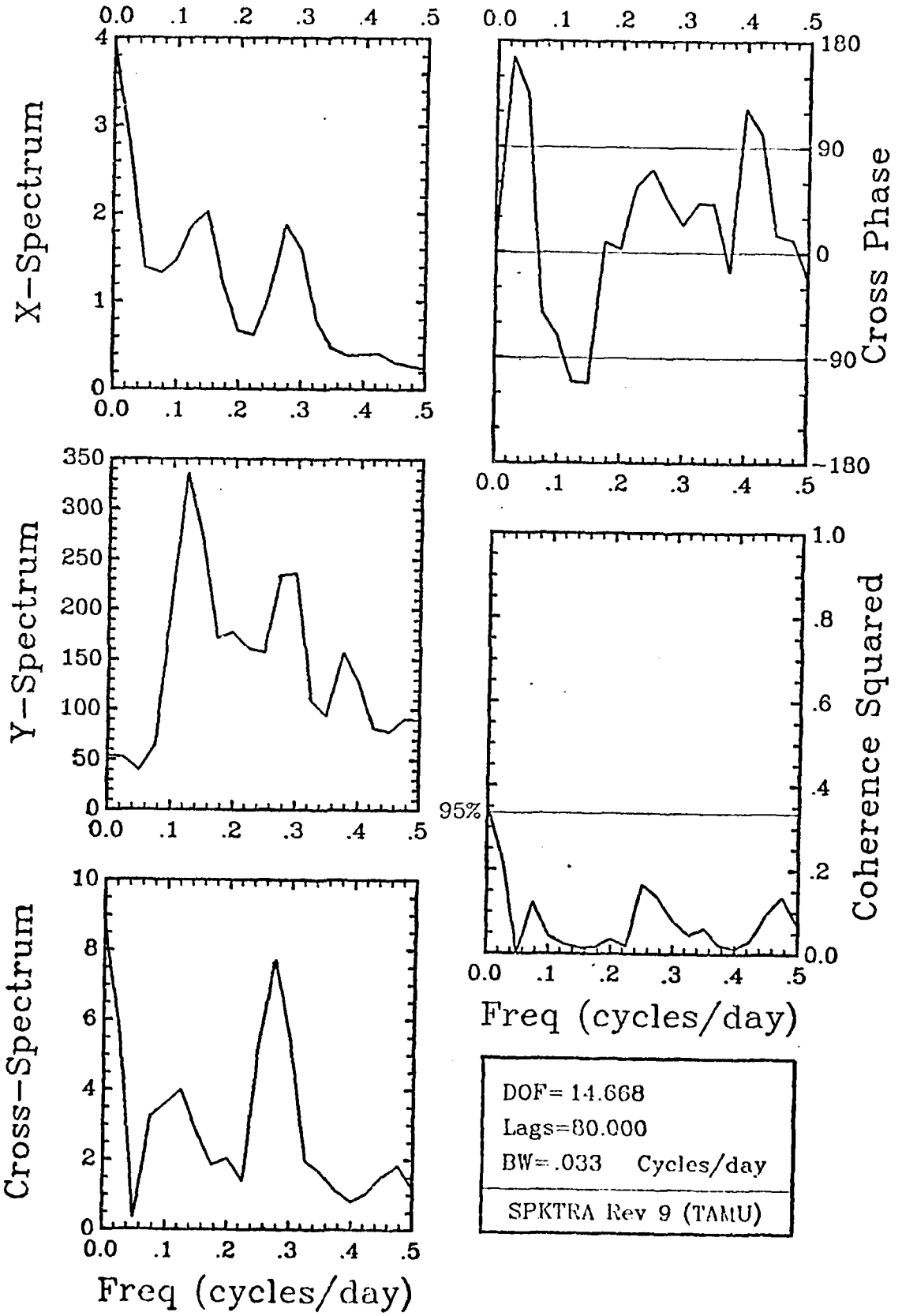

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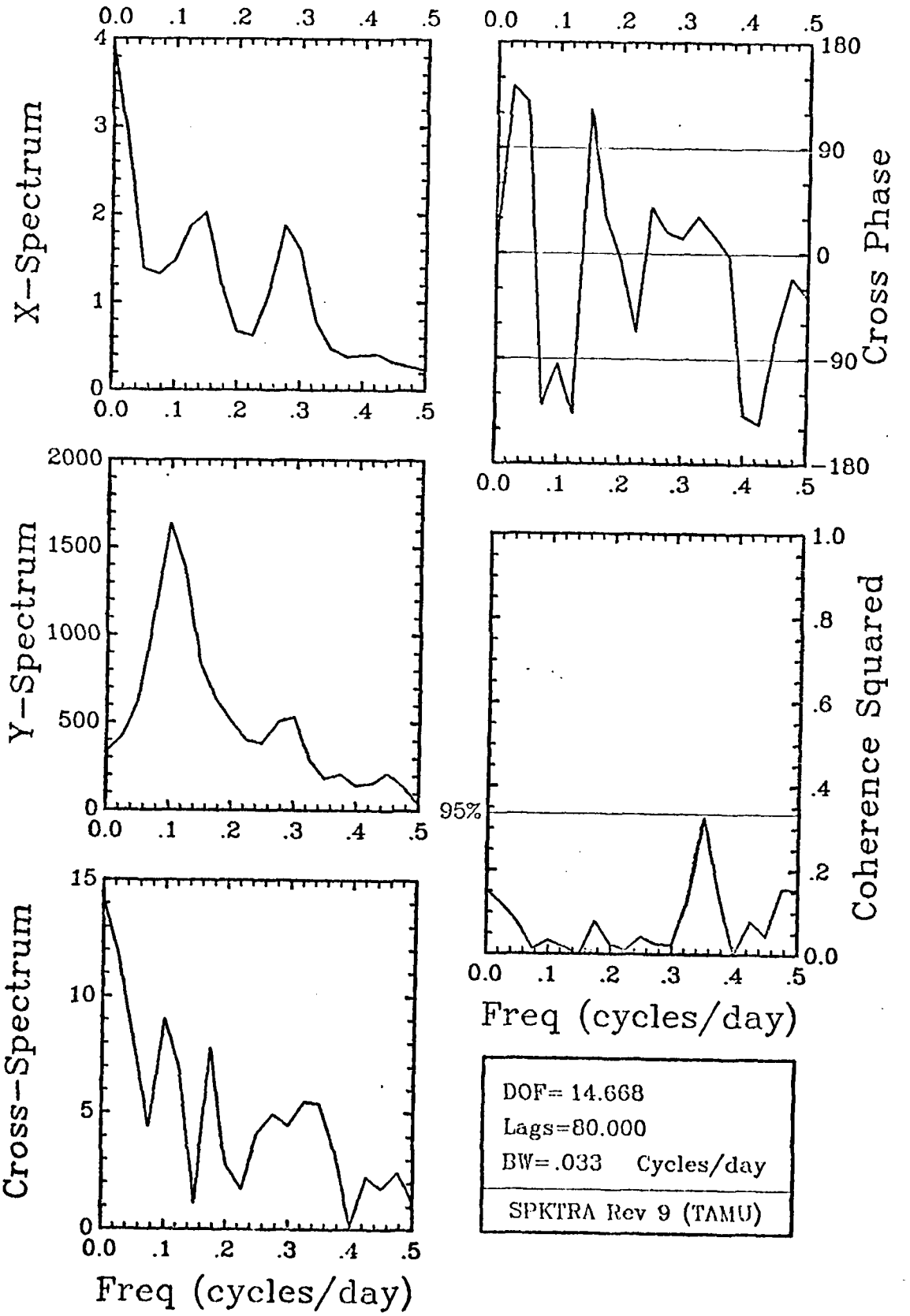

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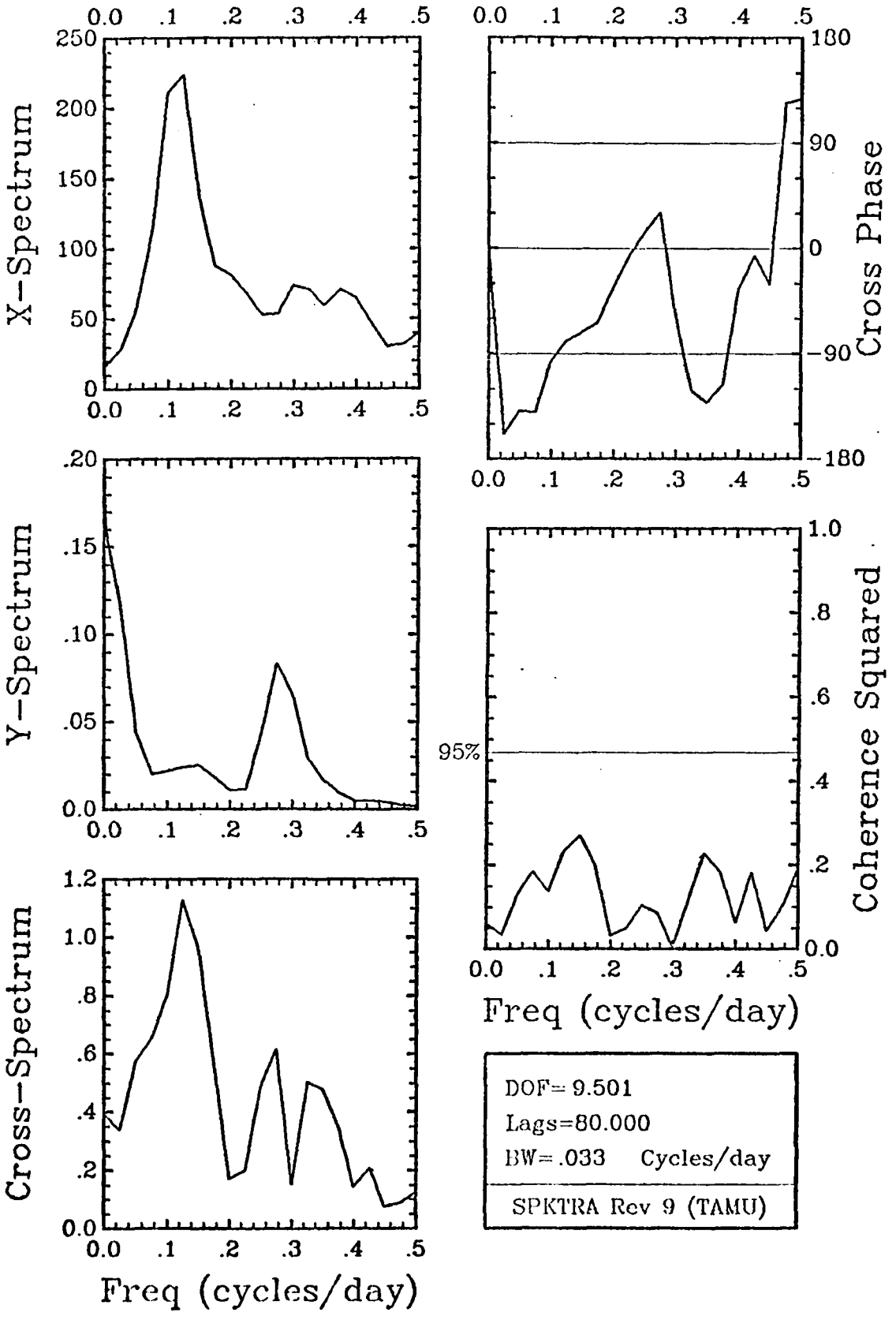

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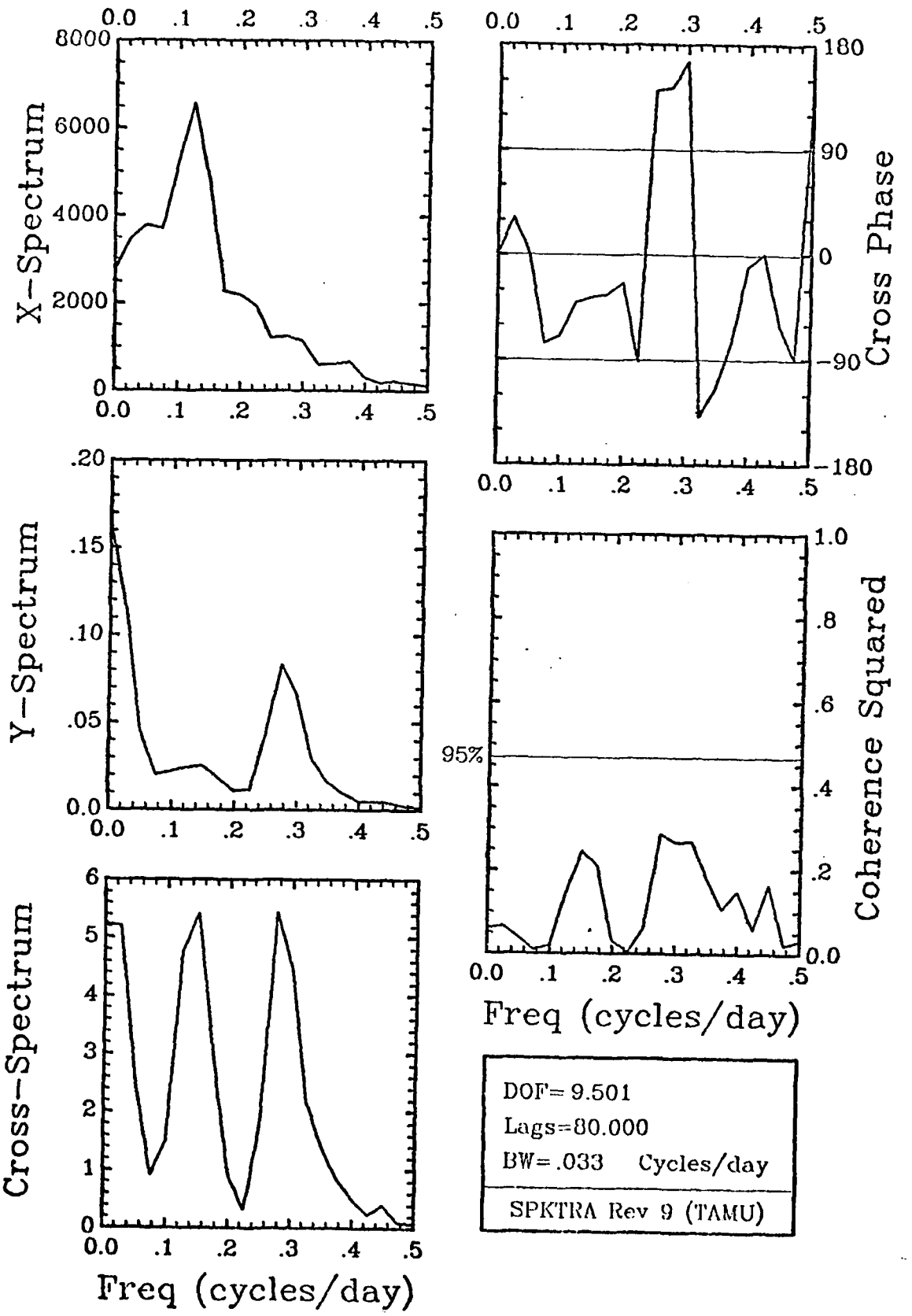

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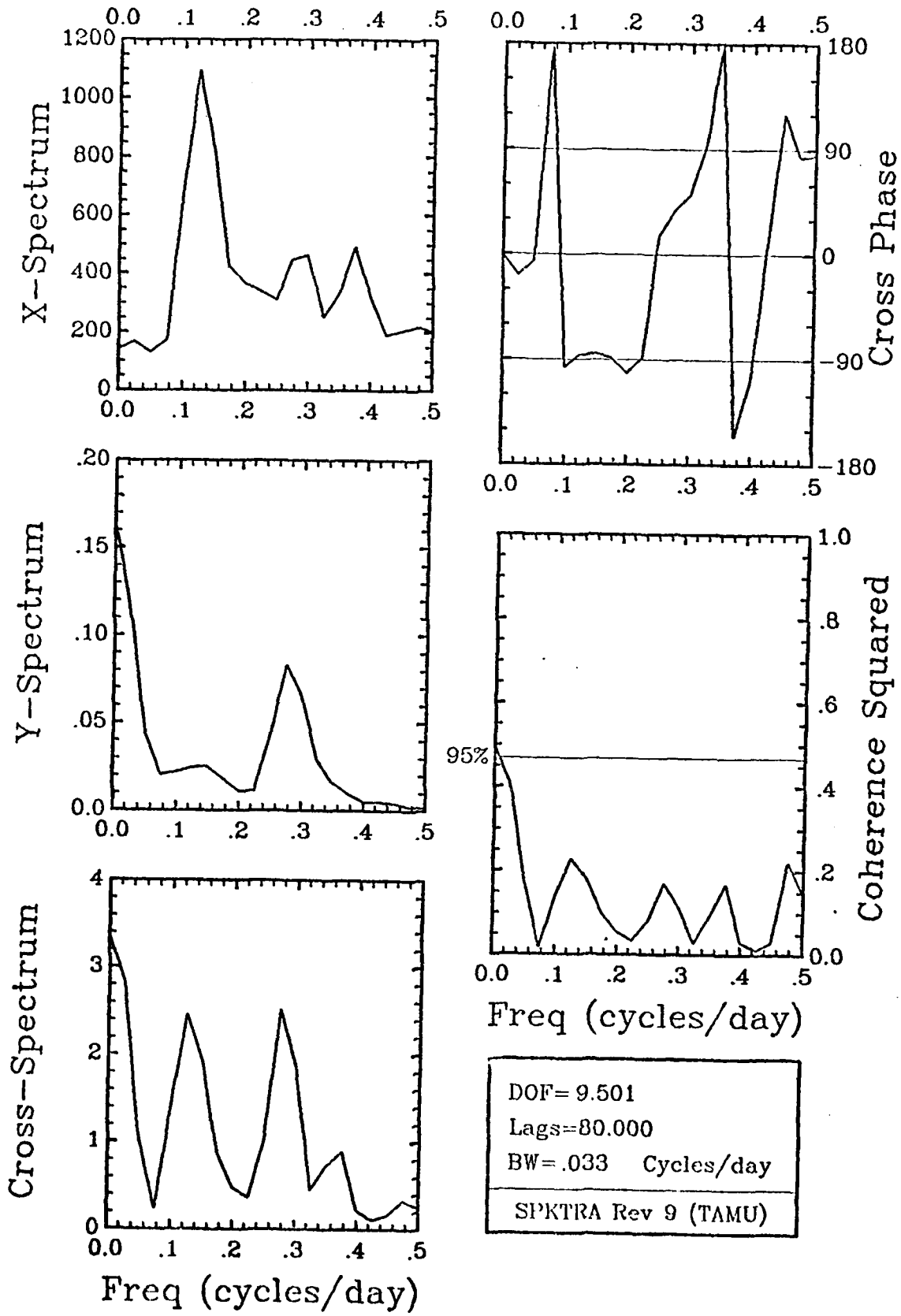

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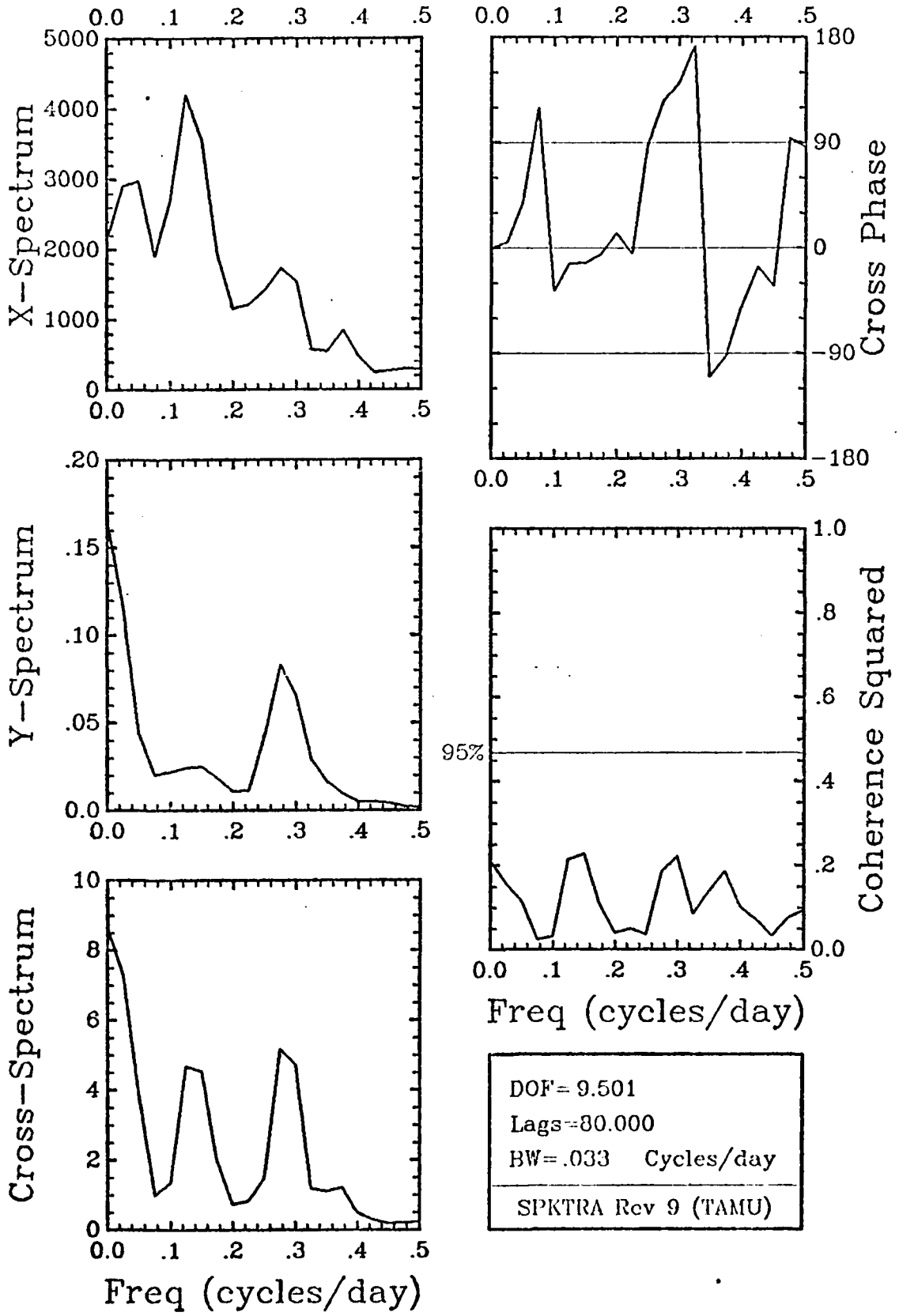

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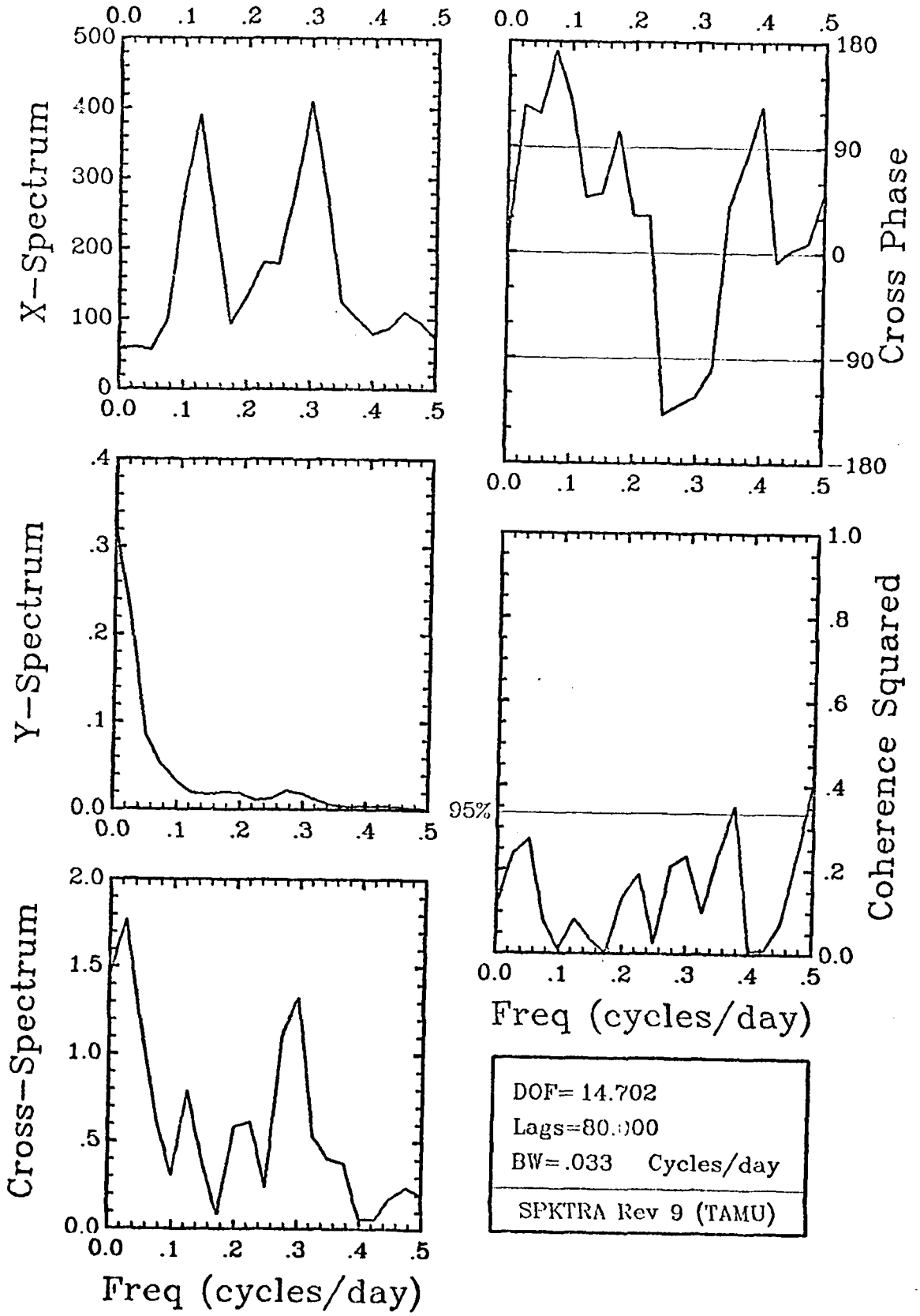

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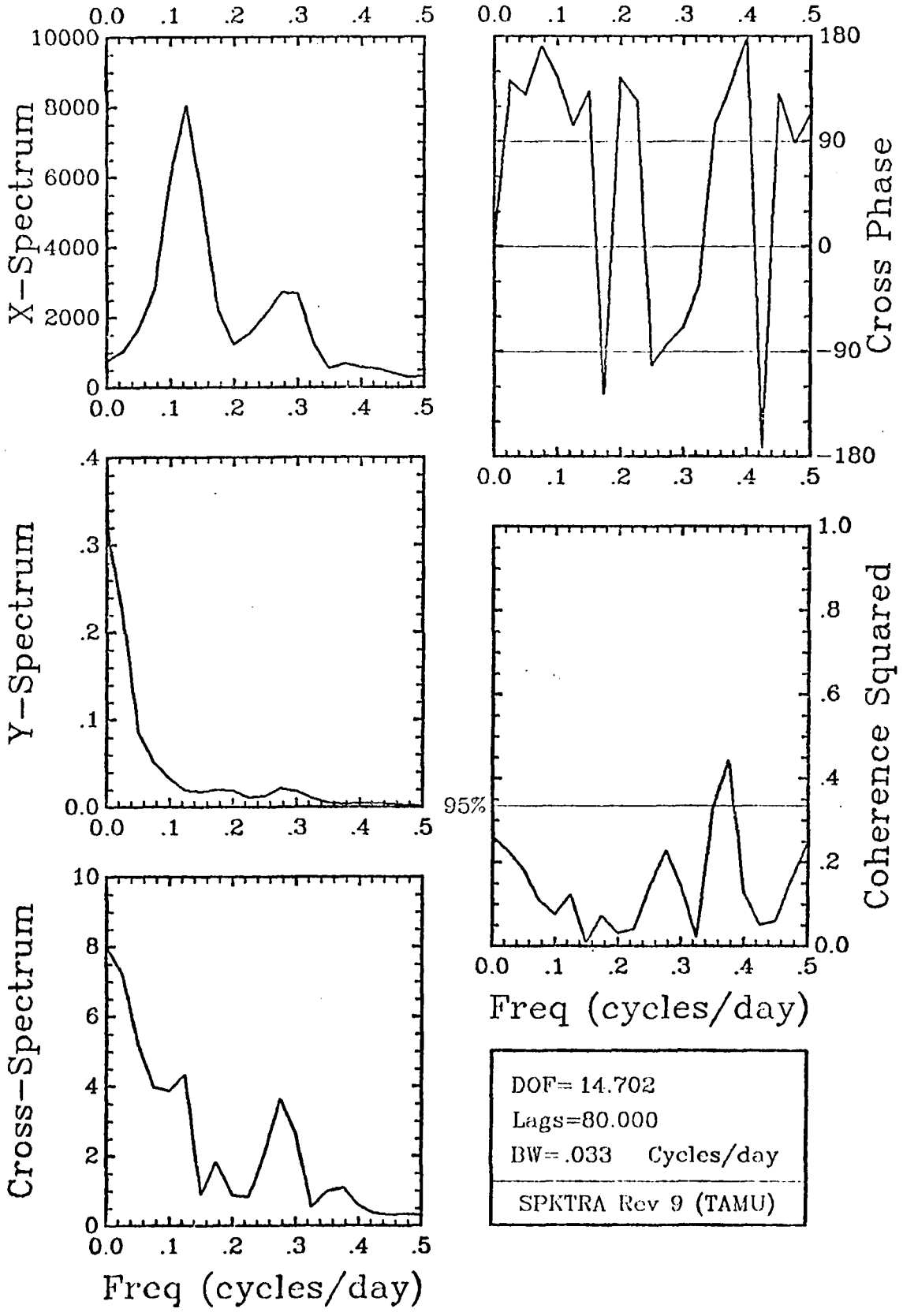

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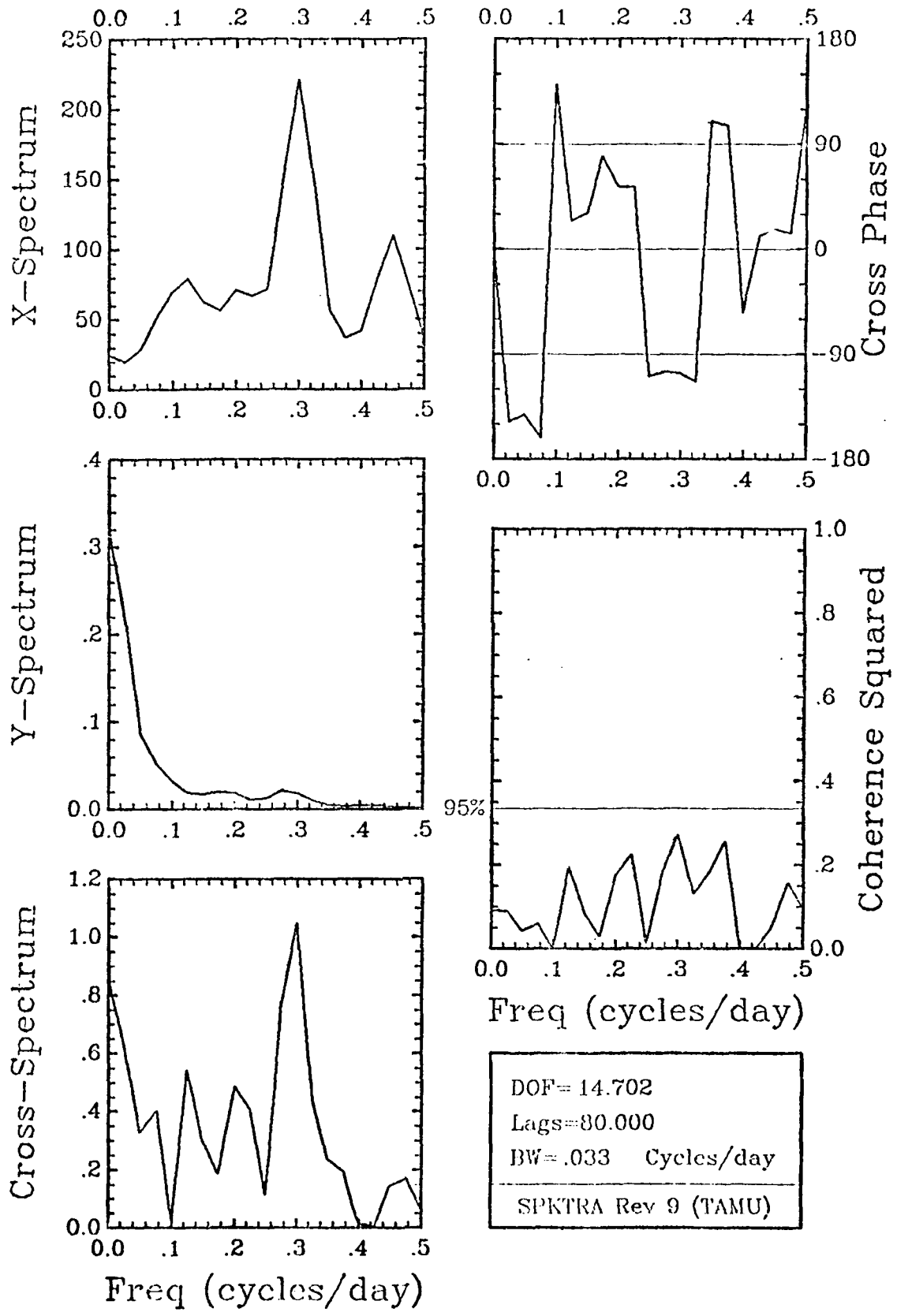

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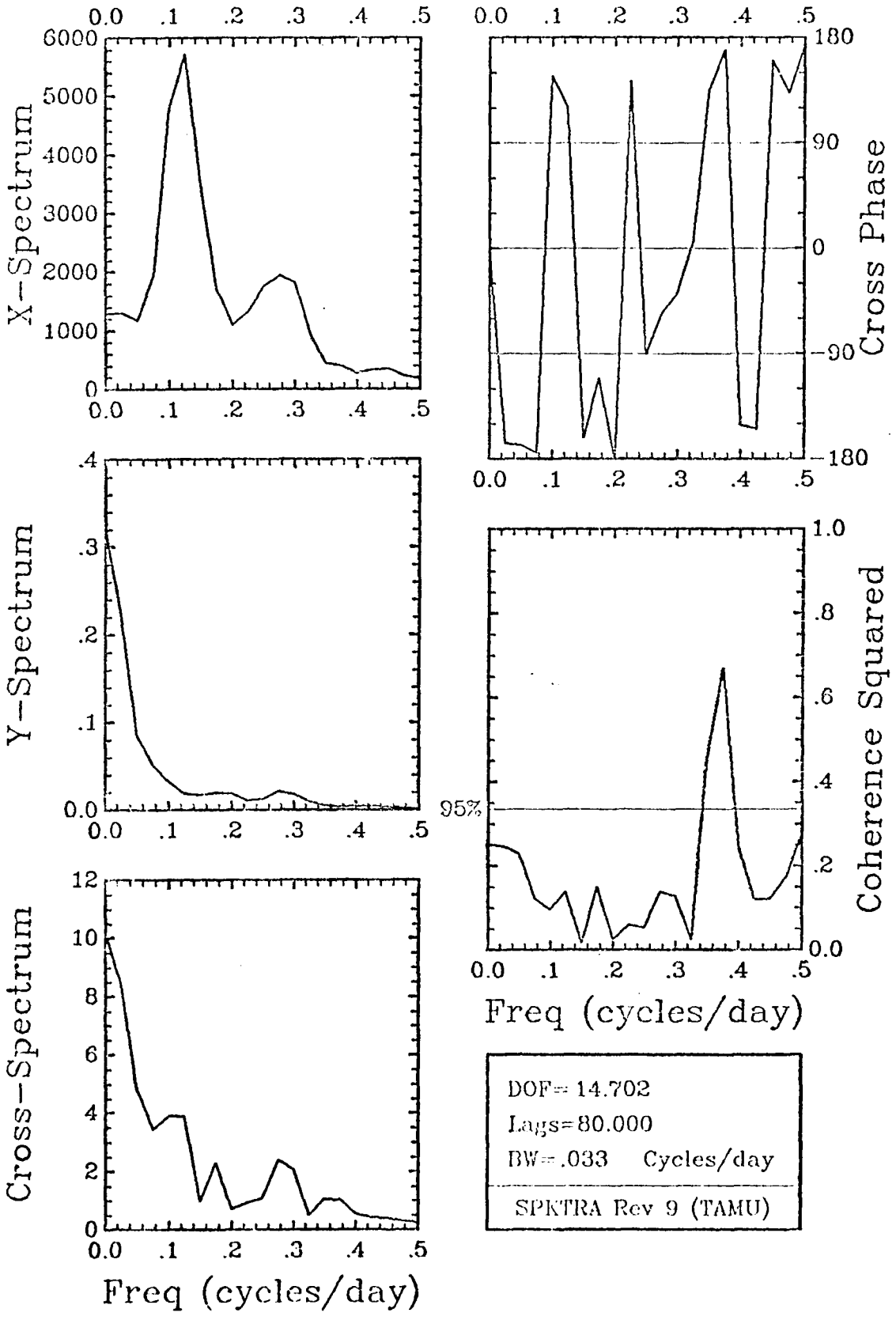

$D_M V$ / ADJ SL_{BFT} Winter 40 HR LP

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Current, sea level, and atmospheric data from the Gulf Stream region off North Carolina for the period January - May 1979 are documented in this data report.

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